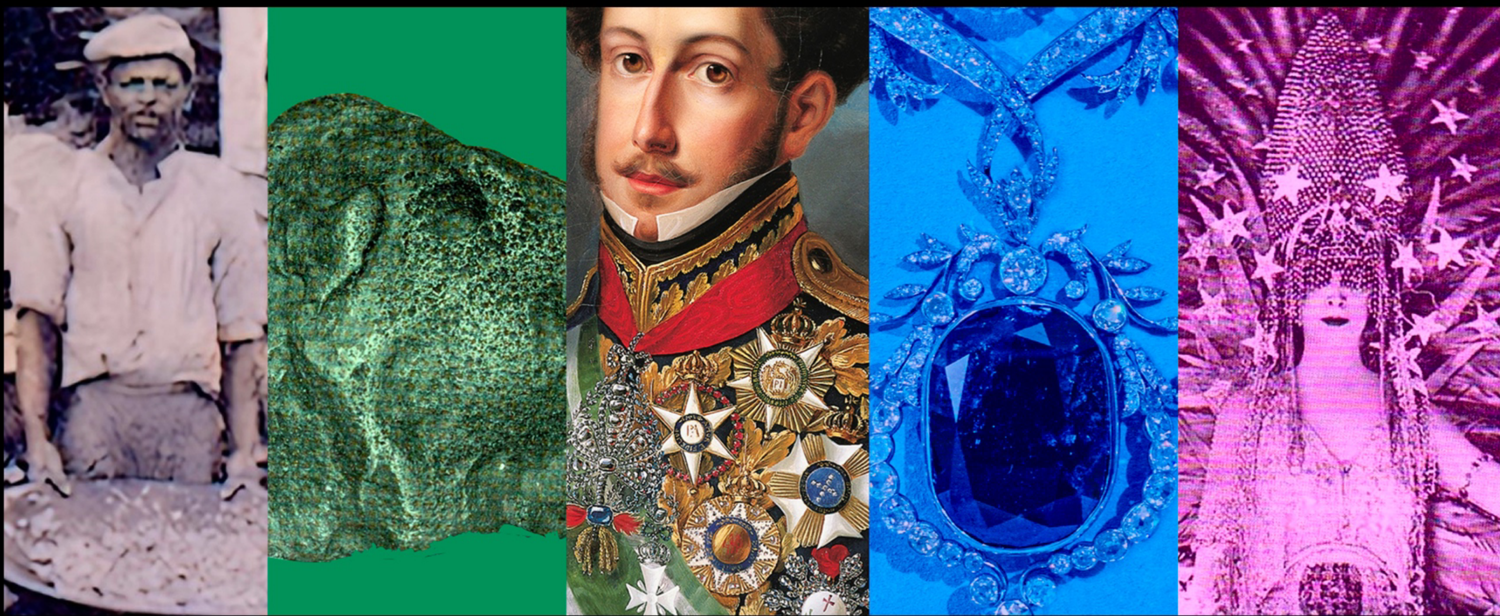
THE ULTIMATE SECRETS OF A CURSED DIAMOND

François Farges



The true but untold story
of the largest diamond of all times

(and He is even LARGER !)

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The Ultimate Secrets of a Cursed Diamond

François Farges

The true and untold story
of the largest diamond of all times

(and He is even larger than we thought!)

Self-Edition

Summary

The world's largest diamond, the Sergio, dwarfs the famous South African Cullinan and its royal destiny. A historic cast of this black diamond was rediscovered in London and in Paris in 2023, where it was perfectly preserved in one of the thousands of drawers in the sumptuous Galerie de Minéralogie of the French National Museum of Natural History in Paris, fifteen years after the discovery of the lead cast of the French Blue Diamond of King Louis XIV of France.

This giant black diamond was discovered in 1895 by a poor Brazilian miner called Sergio Borgès de Carvalho, hence its name. A future French Nobel Prize winner, Henri Moissan, fell scientifically in love with this mineral, but could not buy it, instead he casted it. This replica of the Sergio, the most historic of all, has become the standard since the original was destroyed in London in 1902. However, this model was poorly inventoried in Paris at the time and its existence was lost. Its unexpected rediscovery in 2023 allowed this unique diamond to be resurrected, and it is even more impressive, weighing 3245 carats instead of the announced 3167. A duplicate of the cast was donated by the author to the local Miners' Museum of Lençóis (Bahia state) in 2025.

Black diamonds were among the most coveted gems by aristocrats from the 18th to the early 20th centuries, including Wellington, King Louis XVIII of France, and philanthropists such as Jane Stanford. They were used to dig the first great Alpine railway tunnels, the London Underground and the Paris Métro, to drill the great US oil fields for Rockefeller, to build Manhattan's skyscrapers, to open the Suez and Panama Canals and much more.

The driving force behind the industrial revolution of the 19th and 20th centuries, its rich natural and human history are inseparable from the Brazilian Chapada Diamantina, the *jâre* of the ancient slaves and today's *garimpeiros*, its rich mineralogical and mining lexicon, the splendour of the crowns of Portugal and Brazil and the influence of Parisian jewellers in Bahia. This diamond also illustrates - once again - how human vanity stops at aesthetics, ignoring a "broken face of nature" whose ultimate sacrifice allows us today to travel, to fill ourselves with hydrocarbons and manufactured products from the other side of the planet.

And there is much more: black diamonds are also an essential milestone in the geological history of this evolving Earth: they could have taught us so much about the origins of our planet, and perhaps even of life, or even of ourselves, according to the latest scientific findings.

Here is the outrageous story, enriched with more than 300 illustrations, of a billion-year-old wonder of nature sacrificed for our comfort, but which today's science has made it possible to partially reconstruct.

Keywords: diamond, jewels, carbonado, Sergio, Bahia, Brazil, Dufrénoy, Des Cloizeaux, Lacroix, Moissan, MNHN.

Foreword

This e-book is a scientific essay that seeks to retrace a scientific adventure that I constructed as an investigation over the course of a year, between the summers of 2023 and 2024. This work is far from complete.

I was moved by the little-known story of this unloved diamond: it led me down a number of paths, between science, history and art, and also to the discovery, albeit distant, of the cultures of the Chapada Diamantina in Brazil.

Here, the scientific, mineralogical and historical discourse is as important as that of the local traditions of Bahia. It also also covers a lot of French history, as that is what I know best.

I have tried to build up the story of this extraordinary diamond by alternating chapters, between those that will appeal more to scientists and those that will be of more interest in the historical, artistic or sociological sections.

I did not explicited the British period of time of Sergio (1895-1902) as this is well described within the great articles or Hansen and co-authors. And because the previous periods are way more obscure. Also, this is basically a Portugal-Brazil-French story.

In any case, the saga of this diamond brings together all these aspects in an inseparable way.

I have tried to integrate the technical jargon as much as possible by explaining it.

Grey boxes of text complete the book on peripheral subjects.

I wanted this book to be free and in three languages (French, English and Portuguese). So that as many people as possible can read it.

This translation into English of the French original text was made first through Deepl and reviewed afterwards.

This book received no editorial or financial support. I hope that its residual flaws and mistypings will not detract from its readability.

François Farges – Paris, May 2025.

Je dédie les trois versions de ce livre à tous les habitants de la Chapada Diamantina pour leur immense mais méconnu héritage laissé à notre monde.

I dedicate the three versions of this book to all the inhabitants of the Chapada Diamantina for their immense and little-known legacy to our world.

Dedico as três versões deste livro a todos os habitantes da Chapada Diamantina por seu imenso e pouco conhecido legado ao nosso mundo.

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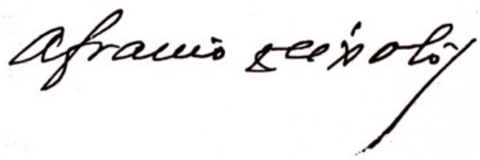
I. ANCIENT TIMES

Não é encantador pensar que
minha terrinha humilde do sertão da Bahia
é quem permite a Nova Iorque, ou a Londres, ou a Paris,
as suas cidades subterrâneas,
por onde passam os metropolitanos, e a água, servida ou potável,
que são a vida dessas capitais do mundo?
Para o escavar na rocha a transpor, e logo perfurada,
foi preciso um carbonato de Lençóis.
Lençóis concorre assim, poderosa eficientemente,
para a civilização orgulhosa do mundo,
que o esquece... What does it matter?
Se nem a pedra o confessa, nem o proclamam os beneficiados;
melhor nosso orgulho é esse mesmo, fazer o bem,
que é o dever, sem esperar o reconhecimento...

Isn't it charming to think that
my humble homeland in the hinterland of Bahia
is the one in New York, London or Paris,
in their underground cities
where subways and water circulate, whether served or potable,
which are the lifeblood of these capitals of the world?
To excavate it in of the rock to be drilled through,
a carbonado de Lençóis was needed.
Lençóis thus contributes, powerfully and effectively,
to the proud civilisation of the world,
which forgets... But what does it matter?
If the stone does not confess it, the beneficiaries do not proclaim it;
that we should be proud of, that we should do good,
which is our duty, without expecting any recognition...



Afrânio Peixoto (1876-1947) *Breviário da Bahia* (1945, reed. 1980, p. 239) and his signature

A First Secret

1. The natures of diamonds

What gemstone has been the subject of so many superlatives if not the diamond? Except in the Far East, where jadeite and ruby will never share their glorious thrones, the diamond, as a celebrated gem, embodies the quintessential fascination of *objets d'art* marked by a glittering but tormented history, tossed between the covetousness of sovereigns and the whims of film icons. This influence is detrimental to the mineral, which is often neglected in the geology collections of natural history museums because of its high price. It is not widely available to science, the only set of instruments that can decipher the great grimoire of its origins. It remains confined to the circuits of miners and diamond merchants, even though it is not as rare and eternal as their salesmen would have us believe. There are so many mineral species that are much rarer than diamonds such as, among many others, alexandrite (green-red) or benitoite (blue). Nowadays, hardly a month goes by without news of the discovery of a diamond weighing several hundred carats in some remote mine. Once the exceptional, specimens of this calibre are now almost commonplace (relatively speaking), including varieties with the bright colours so sought after: sparkling yellow, steel blue, acid pink, deep green and even carnivorous red, among others. Many of these superb crystals are directly facetted, without researchers being able to unravel the mysteries of how they crystallise in the depths of our planet.

At the mine, diamonds are often collected as isolated crystals, detached from their despised gangue and thrown in the dumps, even though they hold the keys to the past geological events that saw them form, move and transform. This detachment, both literally and figuratively, means that diamonds lose its naturalistic aesthetic that is so hard to imagine because it has been rendered invisible by the commercial circuits in the form of a round, 57-facetted brilliance that is no longer surprising. Unfortunately, diamonds do not form spectacular geodes like amethysts, nor do they form gleaming associations with other remarkably colourful species such as certain tourmalines, aquamarines,

emeralds or topaz crystals just to cite a few. However, diamonds can display magnificent transparency, at least in the best cases, a great diversity of colours and are quite frequently automorphic (or euhedral), i.e., they form (sometimes beautiful) crystals with geometric shapes that oscillate between astonishing simplicity and the most aesthetic complexity. Every day the mines around the world produce new forms that will surprise even the most casual mineralogist.

Figure 1 . The best-known diamond types (from left to right, top to bottom). First line : four colourless to coloured octahedra, two octahedra with graphite or hydrogen inclusions, the second being "asteriated" or petalled, as a polished section); (first row below) tetrahexahedron ("rounded rhombododecahedron"), composite crystal, irregular crystal (due to later dissolution) and three cuboids ; (second line below) three crystal-twins (two spinel and one star of David) and a set of colourless to black fibrous spherules (ballas) ; (bottom line) "fancy" crystals, a bort and a carbonado (essentially from South Africa except for the asteriated diamonds and carbonado which are Brazilian and the three cuboids from the R.D. Congo; scales vary from centimetre to centimetre). On the left, jewellery quality; on the right, industrial quality. Paris, MNHN, mineralogy, numerous inventory numbers (mainly gifts from R. Bischoffsheim and L. Taub, 1890). Photos: © François Farges/MNHN.

From octahedral to rhombododecahedral morphologies, it is even one of the few to form crystals with curved edges, an apparent heresy when it comes

to geometry. This challenge can be explained by the gradual resorption (loss of volume) of the octahedron's sharp corners as it rises in the magma. Magma, as a crystal lift, can also corrode its passengers. It also leaves its marks in the form of elegant, more or less interlocking triangular shapes, known as dissolution figures, that are unique to each crystal. This process eventually results in a tetrahexahedron, a sort of rounded rhombododecahedron (Figure 1). Diamonds also form numerous crystal-twinning, which are oriented associations of crystals that are particularly sought after by collectors for their rarity and aesthetic appeal, notably the "Star of David", which is striking for its simplicity with a hint of complexity (Figure 1).

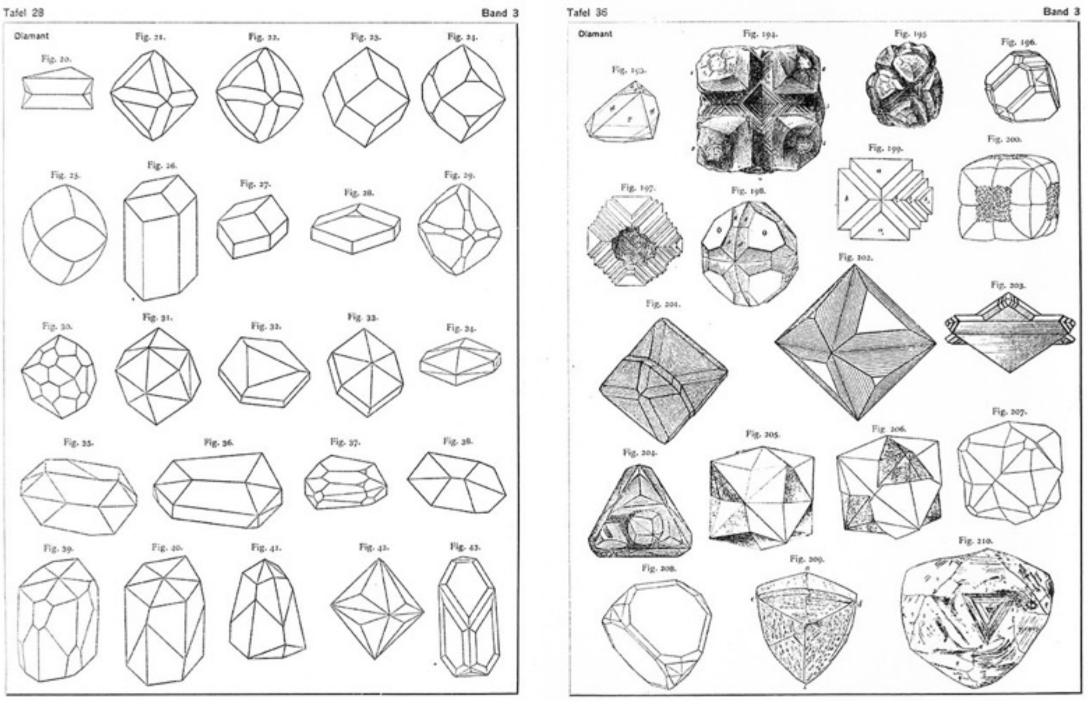


Figure 2 . Example of two plates of diamond crystallography by Goldschmidt (1913, Volume III, plates 28 and 36) illustrating the great diversity of shapes of natural diamond crystals. Source: archive.org.

In fact, diamonds are one of the minerals with the greatest diversity of known crystalline forms, with hundreds of geometries recorded since the last century, when diamond dealers, sympathetic to scientists, let them examine their reserves of crystals ready for faceting. Magnificent plates by the German mineralogist Victor Mordechai Goldschmidt (1853-1933) illustrate some of the 364 different crystalline forms he recorded (Goldschmidt, 1913; Figure 2).

However, this cataloguing of crystalline forms was quickly abandoned – as early as 1915 – because of the abundance of forms encountered since then, probably thousands of which have remained undocumented since crystals have become difficult for scientists to access. And that's not all: diamonds also form irregular, transparent masses, often single crystals that are partly naturally dissolved. Second, diamond can also agregate as microcrystalline volumes known as bort (or edge, boort, board) when their shape is irregular while others have evocative names: cuboids and ballas (with the shape of a cube or a ball, respectively). Thirdly, polycrystalline aggregates are named diamondites are complex and variable polycrystalline assemblages, but essentially contain diamond microcrystallites (carbonado, yakutite, etc.). There are three main types of "black diamond": monocrystalline (as at Marange in Zimbabwe), microcrystalline (bort, cuboids and ballas, which are fairly rare in black because they tend to be white, grey or yellow to orange to brown) and polycrystalline (carbonados, dark brown, more or less greyish or brownish). As a result of this geodiversity, diamonds have been enriched with incomparable treasures of knowledge throughout the 20th century, but they remain the great forgotten of mineral collections, even though, paradoxically, they remain so coveted and celebrated.

We leave aside the industrially treated black diamonds: these are usually diamonds with high density of natural inclusions (sometimes called "salt-and-pepper") that have been polished hard to blacken their facets by graphitization so that they appear uniformly black (but only on their surface). These are currently the most common black diamonds on the market, tarnishing the reputation of genuine black diamonds.

2. Diamonds from the "old mines"

Figure 3 . The fort at Golkonda overlooks the gardens of the *Nagina Bagh* (literally "a jewel among gardens") where Indian diamonds were traded during the royal period of Golkonda and then the imperial Mughal period. The major mines, including Kollur, Raolconda and Paritala, are much further away, up to several hundred kilometres. In the foreground, a zirconia replica of Tavernier Blue diamond, 115-carat, which may have passed through this market before being bought by Jean (Baptiste) Tavernier and sold to the Sun King in 1668. Cliché (and fingers): © François Farges.

The frenzy for this gemstone has been documented since Antiquity, when princes from the East (India) and the West (Europe) competed for these minerals, which came mainly from Indian mines, but also from those in Borneo (Sun et al., 2005). Indian production – including imports from this Indonesian island – is grouped together under the term "Golconda", a generic name for a historical provenance of so-called prestigious diamonds. It is borrowed from the name of the citadel of Golkonda (Figure 3) built around the former capital of the eponymous kingdom (1364-1512), now located on the outskirts of

Hyderabad in the state of Telangana in south-central India. Like Surat (Gujarat, in north-west India), this locality was first and foremost a trading centre, and many crystals converged here from deposits in other provinces, scattered between Andhra Pradesh, Orissa (Odisha) and Kalimantan (Borneo), as described by various European explorers, including the French trader Jean (Baptiste) Tavernier (1605-1689; and not "Jean-Baptiste" as commonly referred by mistake, see Figure 4). His descriptions of the mines and the stones discovered and facetted (Tavernier, 1676) remain, unfortunately, too imprecise for today's standards.

Figure 4 . David Klöcker Ehrenstrahl (-1698) / Nicolas de Largillière (1656-1746): portraits of Jean (-) Baptiste Tavernier (1688, Nationalmuseum, Stockholm / circa 1678, Herzog Anton Ulrich-Museum, Brunswick). Tavernier signed "Jean" in the French Archives nationales (Paris, Minutier des notaires) in accordance with the title of the Swedish painting. "Jean-Baptiste" is a typographical error from the early 18th century that has since become established: although the second painting was originally entitled "Jean-Baptiste", as its museum claims, this work is posthumous (first half of the 18th century) and inspired by an engraving by Johann Hainzelmann published in 1679 (correctly entitled "JBT" and not J-BT), which is the original. Below, the autograph signature of Jean Tavernier (not Jean-Baptiste), dated 1683. Paris, Archives nationales, Minutier, ET-MXXIII-524).

It is less well known that these jewellery lusts involved cutting and polishing almost all of the millions of Asian crystals to set them on various precious objects that historians call “parade pieces”: jewels, home furnishings, embroidery, etc. I know of no significant natural specimen – other than hearsay, especially in India, but never observed myself – that has survived these periods, other than gem crystals of various very subtle colours, but millimetre-sized, that have escaped the vigilance of former miners and lapidaries (Figure 5). Naturalist collections therefore remain particularly poor in Asian diamond crystals, the most sought-after of all, because they have been sacrificed on the altar of art. As a consequence, prospectors are still struggling to understand these legendary ancient deposits because they have been exhausted: little is known about the geological clues that would make it possible to characterise them.

Figure 5 . Five “*fancy*” diamond crystals (together weighing 3.50 carats) known as “Golconda diamonds”, actually from the Cuddapah basin region (Kadapa, Andra Pradesh, India) extracted in the 20th century from old mine spoil reworked using modern methods. Legacy of Colonel Louis Vésigné, 1955. Paris, MNHN, mineralogy, inv. 195.180. Photo: © François Farges/MNHN.

We therefore lack the precise and detailed geological information that would enable us to find new Indian deposits as fabulous as the old ones. Especially as diamonds do not form rich deposits, unlike certain metals such as iron or uranium, which are still detectable with today's technologies even if they are hidden by thick layers of rocks. Diamonds, on the other hand, are widely dispersed among their hosts: a few grams for around ten tonnes, or at best half a pinhead in a field of haystacks. In India, its historical deposits, which were mainly productive between antiquity and the 18th century, appear to have been formed in ancient riverbeds around a billion years old, which were outcropping or only slightly buried at a depth of a few metres (Chalapathi Rao *et al.*, 2010). Nevertheless, some of these diamondiferous palaeochannels may have since been completely covered – and therefore invisible – by other, more or less thick layers of more recent sediments, making them invisible even to today's most skilled prospector. No survey would be lucky enough to find one of these diamonds: they would all be sterile. But some would be false-negatives, because the drill would inevitably have passed within a few centimetres of a unique or even superb crystal.

How can you spot a deposit if you are geologically blind? There is, however, what geologists call paragenesis: the association of diamond with of certain more abundant minerals that accompany the precious mineral in its deposit and announce it. Parageneses have been collected, described and understood in various deposits in South Africa and Siberia, for example, because science had time to sample and characterise them in the 20th century, before it was too late, i.e., before the deposits were irreversibly depleted of their substances. However, this was not the case in India during the glorious era of the Golconda mines in the 19th and 18th centuries because science was still in its infancy. The drying up of Indian production from the mythical Golconda mines in the 18th century has resulted in major gaps in sampling, without which it is impossible to build a reasoned exploration strategy for potential deposits that are inevitably less easily accessible.

3. Then came the diamonds of the "New Mine"

Figure 6 . Geopolitical context of the Brazilian states of Minas Gerais (yellow border) and Bahia (red), locating the towns mentioned and the Espinhaço geological supergroup (light blue). Redrawn and captioned by the author on the World Wind map base (© NASA).

Around the same time, Brazil (Figure 6) became a major producer of diamonds as early as 1725 (Svisero *et al.*, 2017), then known as "Western" or "New Mine" diamonds (Mercure de France, November 1731, p. 3049). These deposits are fairly comparable to those in India: diamondiferous gravels deposited by ancient and modern watercourses. Those located at the surface were easily recognised and mined in the search for alluvial gold, as diamonds follow this precious metal in alluvial deposits due to their higher density than that of the gravels, which are essentially fragments of siliceous rock. Several deposits have been identified in Minas Gerais: their names were changed to reflect their mining past: the town of Arraial do Tejuco became Diamantina,

the Santo Antônio do Itacambiraçu mine was renamed “Arraial da Serra de Grão Mogol”, which was simplified to “Grão Mogol” after new deposits were discovered in the region in 1827 (Cattelle, 1911, p. 181) and in reference to the largest known diamond in the 18th century, the Grand Mogol, a Golconda diamond weighing more than 280 carats (Tavernier, 1676; Figure 7).

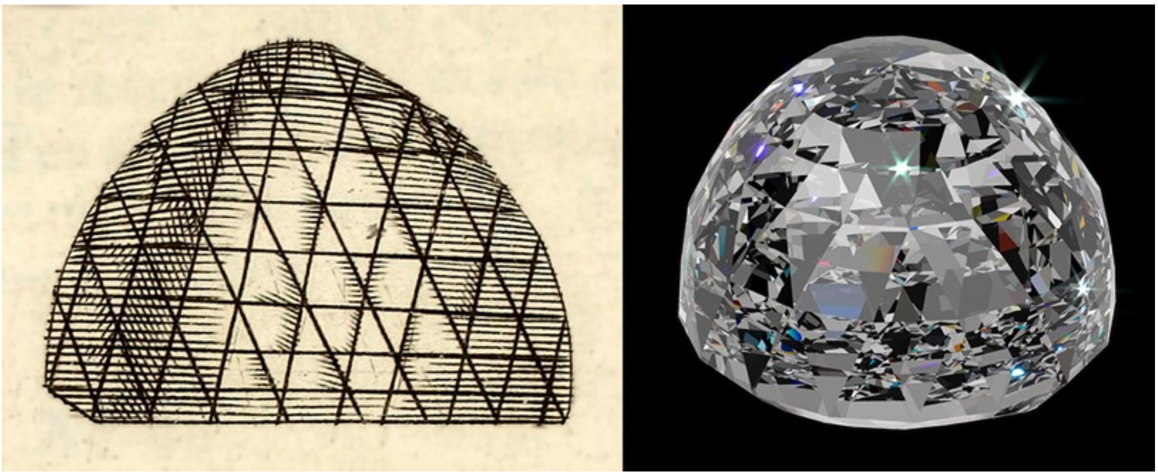


Figure 7 . The diamond known as Great Mughal according to Tavernier (1676, II, p. 334) and its photorealistic simulation (DiamCalc). Crédits : © BnF et © François Farges.

Other deposits were later found in Mato Grosso (Diamantino) and then in the state of Bahia: these *Lavras Diamantinas* (literally Diamond Mines) were renamed “Chapada Diamantina” (Diamond Plateau) around 1905 (I haven't found the exact date). This term refers not only to a region, but also to a culture and an imagination that was inspired by the miners in search of gold and then diamonds. In fact, the term is at the heart of the clearing and human colonisation of the Chapada Diamantina (Bandeira, 1997).

Production was so high that the Kingdom of Portugal imposed various restrictions on mining to keep diamond prices as high as possible, as this mineral was the guarantor of its splendour and power in a Europe made up of much more populous, powerful and expansionist countries such as France, the United Kingdom and, of course, Spain. This was without taking into account the trafficking inherent in the covetousness aroused by this gem. Historians currently estimate that as many Brazilian diamonds arrived in Europe in the 18th century through legal mining as through smuggling (see, for example,

Barretto de Almeida, 2020; Teixeira, 2021). At the same time, Northern Europe – which did not (yet) have any deposits in its colonial hands – was responding to that monopoly of natural resources with some high technology of the time. For example, the Alsatian jeweller Georges Frédéric Strass (1701-1773) developed his eponymous glass also named rhinestone (Haug, 1961; Figure 8).

Figure 8 . Advertising leaflet for Georges Frédéric Strass). It translates as follows: "Jeweller to the King residing / at the Quai des Orfèvres in Paris, at [the sign of] the Duke of Burgundy / informs Mr. the Makers of art works/of all countries, provinces and nations that he possesses / in ultimate perfection the secret of well/making white leaves [paillons to be set under gemstone to enhance their brightness; here, most likely tin foils], as well as those / of all other colours [usually copper]. Paints all kinds / of stones very advantageously, equal to / those of the Orient. Sells perfect gold dust / and will send on request to anyone / who wants diamonds and other precious / stones, in art works or not set, in bulk / and retail. All at a very fair price". The "stones of the Orient" includes, by then, the most highly prized gems (outside emerald), i.e., diamonds, rubies and sapphires. Unlike today, these improvement techniques were highly valued at the time, like a form of "high technology", such as painting diamonds on their undersides to obtain hundreds of brilliants of the same colour for pavé settings with perfectly calibrated colours. Thus, Georges Frédéric Strass was succeeded by Pierre-André Jacqmin, who reused this painting technique in his insignia of the Golden Fleece (Figure 59) and with whom Georges Frédéric Bapst served his apprenticeship apprentissage (Figure 129). This jewel and these two jewellers are discussed later in this book. Image source: Escard (1914) said to be from the collection of de Wever, but certified by Germain

Bapst (1889) to have come from his family, themselves direct heirs of Strass. Credit: Paris, Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. 110.145.

Figure 9 . Box containing an historical rhinestone model of the “diamant le Régent appartenant à la Couronne de France” (the Régent diamond belonging to the Crown of France) according to its inventory most probably dating from the 18th century (inventoried in 1822 on the basis of a collection mainly from the French Ancien Régime). Its proportions (3.17 x 2.94 cm) and some of the faceting details are not exact, as the original is slightly less rectangular (3.2 x 3.1 cm according to the Louvre): these differences are deliberate for security reasons, as the model must be quickly distinguishable from the original (the weights are also different: 150.3 vs. 140.62 carats). However, its precious red case, marked above with gold leaf (not visible here), is reminiscent of the French Crown Jewels. W x H: 3.17 x 2.94 cm. Paris, MNHN, mineralogy, inv. 22.145. Photo credit: © François Farges/MNHN.

This recipe, based on that for leaded glass known since Mesopotamian antiquity, is enriched by Strass with other so-called heavy metals (bismuth and thallium), which differentiates it from the “crystal” (implied “lead crystal”) with which Strass is often confused, particularly English leaded glass. The resulting

increase in the density of the glass was perfectly balanced to ensure that the vitrified material remained transparent and relatively colourless. Sometimes, Strass coated the lower side of lead glass with metal powder (tin). The difficulty in developing this material lay in obtaining the two heavy metals, especially thallium, which were very little used at the time and therefore rare. This recipe gave the rhinestone a higher refractive index and therefore higher optical dispersion when faceted than its English ancestor.

When this rhinestone is properly faceted – because it is necessary to respect the particular angles defined by the laws of geometrical optics in this material, another high-tech element of the time – it induces “fires” that make it comparable to diamonds, at least for non-expert eyes, including those of sovereigns (Figure 9). This glass, decidedly high-tech, eclipsed the diamond to such an extent that Strass became jeweller to King Louis XV and the Crown of France in 1734. The old aristocracy even deplored the fact that Louis XV's court was able to adorn itself with these “threepenny” diamond substitutes when his great-grandfather, Louis XIV, had so celebrated the original gem during the first part of his reign (1661-1683; Farges et al., 2017). To rub salt in the wound, Georges Frédéric was even one of the few jewellers to leave a considerable fortune at his death: once again, high-tech was to blame. And conservatives and others nostalgic for “the good old days” were once again lost in their dismay.

4. From greed to Lights

Between smuggling and rhinestones, the price of diamonds plummeted: crystals landed on the shelves of Parisian dealers, who enriched their catalogues of *objets d'art* with various curiosities that complemented the former. This purely decorative purpose accentuated the ostentatious nature of the cabinets of curiosities – which were themselves parade objects – displaying an incoherent chaos of natural objects with no logic whatsoever. They were nothing more than pure aesthetics designed to "discover the world" at a time when transcontinental travel was expanding from the "Indies to the Americas", but remained the preserve of a small caste, from soldiers to sailors, including a few missionaries, diplomats and other State employees. The development of the *naturalia* part of these cabinets was staggering in the second half of the 18th century, as every aristocrat made a point of owning one that was larger and, above all, more original and unique than those of his neighbours who visited him, in the same way as private collections of contemporary art today. This development indirectly enabled the natural history cabinets to develop their collections, this time in a reasoned manner, through the intermediary of the same mercantile merchants. This helped to make up for the chronic shortage of diamond specimens in these naturalist collections, which objects were becoming increasingly scientific subjects. The crystals that the least interesting from an optical point of view – and therefore for jewellery – were then easily overlooked for faceting, given their sudden relative abundance. So, the challenge shifted to new paradigms: how can a mineral like diamond form an octahedron or rhombododecahedron (Figure 1), crystals that are so different?

Georges Leclerc, comte de Buffon (1707-1788), superintendent of the *Cabinet royal d'histoire naturelle* (Royal Cabinet of Natural History) in the *Jardin du roi* (King's Garden) in Paris, saw no geometric relationship between such different crystalline forms in a given mineral. And diamonds were no exception in his eyes. He decreed that crystals are not the specific characteristics of a given mineral. In other words, he persuaded his listeners and readers that all minerals, including diamond, can form all possible crystal morphologies. Worse still, he asserted – in true *French fashion* – that any reasoning on the

subject would be useless, vain or even idiotic. Period.

Figure 10 . (left) François-Hubert Drouais (1727-1775): Portrait of Georges-Louis Leclerc, comte de Buffon (1753). Photo credit: Musée Buffon, Montbard (Wikimedia Commons) ; (right) Adam Pérelle (1638-1695): view of the Jardin du roi (near 1660), photo credit : Paris, MNHN, Bibliothèque centrale). The Cabinet royal d'histoire naturelle is kept within the large central building.

Figure 11 . (left) Alexander Roslin (1718-1793): Portrait of Carl von Linné (Carl Linnaeus, 1775), photo credit: ©Nationalmuseum (Stockholm), Wikimedia Commons); (right) anonymous: Portrait of abbot René-Just Haüy (near 1802), Hôtel de ville (Clermont, Oise), photo credit: ©François Farges.

This was without the great Swedish naturalist, Carl von Linné (1707-1778), an intellectual of a different stature (Figure 11, left), perhaps less lyrical than Buffon, but with an immaculate international reputation since the publication in 1735 of his immense *Systema Natura* – System of Nature – which proposed a systematic classification of species in the "three kingdoms of nature", animal, vegetable and mineral, as had never been seen before. For the third kingdom, he tried to organise crystalline forms, but failed, and soon abandoned his project. The torch was taken up by Jean Baptiste Romé de l'Isle (1736-1790) who, in Paris, set about describing as many crystals as possible and grouping them in his own way. He quickly found geometric rules that linked dissimilar crystals together where Buffon had seen none. Romé's demonstration was so convincing that the science of crystals, or crystallography, developed rapidly in Paris. It was quickly followed by abbot René-Just Haüy (1743-1822; Figure 11 right), who also classified crystals in his own way (Farges and Kjellman, 2022; http://hauy2022.free.fr). But his excellent knowledge of mathematics and, more particularly, geometry, enabled him to do what Romé de l'Isle was unwilling (or unable) to attempt: theorise on the constitution and arrangement of crystals based on microscopic nuclei that aggregate to explain the shapes of the specimens he collected. From a crystallography à la Romé de l'Isle, which was certainly visionary but remained descriptive and static, Haüy glimpsed the underlying dynamics that, according to him, animate crystals at the heart of matter.

Between Buffon, who was sidelined, and Romé de l'Isle, who remained too descriptive, Haüy immediately made his mark thanks to his reasoning, which sought to describe as much as to explain. The hyperactive abbot, then a retired Latin teacher, was quickly crowned as the father of modern crystallography (which he still is today, even after the dazzling progress of crystallography, although our views on these subjects today differ markedly from those of the time). But that was not all: Haüy also defined the concept of mineral species, which is still valid today and has earned him the title of "father of modern mineralogy". For him, any mineral species is characterised by the types of chemical elements that make it up and their geometric arrangement (Haüy, 1797). According to this retired Latinist abbot, diamonds are composed

of carbon and form crystals bonded to shapes related to the cube. This is still his current definition, combining crystallography and chemistry ("cubic carbon").

5. The age of Reason

Figure 12 . Two diamond crystals (4 to 5 mm square, approximately 0.3 carats each) mounted on bitumen of Judea and a painted wooden base and labelled from the collection of René-Just Haüy (late 18th -to early 19th centuries), now kept at the Muséum national d'histoire naturelle (Paris). The two inscriptions can be deciphered: they bear the inscriptions "*diamant primitif du Brésil*" (primitive diamond of Brazil, understand octahedral habitus from Brazil) and "diamant sphéroïdal sextuplé du Brésil" (in today's words, a rounded "rhombododecahedral" habitus or, more precisely, a tetrahexahedron, also from Brazil). At that time, diamond crystals came mainly from Minas Gerais, as the historic Indian deposits ("Golconda") were producing almost nothing and those in Bahia were producing probably clandestinely and fraudulently declared to be from Minas Gerais. The second habitus is the most common in the Chapada Diamantina. Photos: © François Farges/MNHN.

Haüy was lucky: thanks to the mines of Minas Gerais, he managed to obtain several dozens of these Brazilian crystals, octahedrons, rhombododecahedrons and macles (following the spinel law), still preserved at the Muséum on the site of the Jardin des plantes in Paris (Figure 12). Haüy was even the first to observe curious stellar figures in a cleavage blade of a Brazilian diamond (Figure 13). The Brazilian specimens thus contributed to the development of scientific knowledge of diamonds, enabling Haüy (1817) to be the first to transfer his definitions, originally applied to crystals with natural facets, to man-made faceted gems. From then on, he was able to rigorously

define and identify this gem (as well as many others) in relation to the numerous counterfeits – including rhinestones – thanks to his scientific reasoning, which could be reproduced and verified by anyone in France or elsewhere. More generally, gemmology – or the science of gems – was born of the achievements of mineralogy and geometric crystallography: Haüy is also the father of modern gemmology (Farges and Kjellman, 2022).

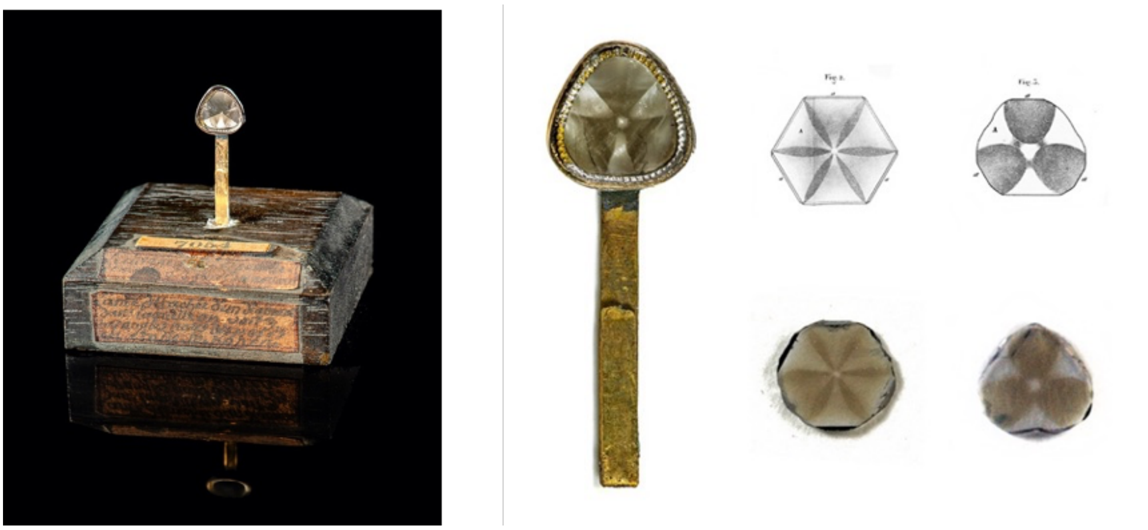


Figure 13 . Diamond cleavage blades showing stellar inclusions (Minas Gerais, Brazil). On the left (on its original base) and in the centre (isolated), a blade set in gold by Haüy, who was the first to observe this type of inclusion (late 18th century to early 19th century, stem: 1.65 x 0.55 cm; 0.22 carats). The label reads (translated from the French): “Detached blade of a diamond showing three black triangles arranged in a star shape”. The inventory adds (same) “The cleavage was made parallel to two faces of the core. Mr Kohen” (the donor). On the right, two isolated thin slices of cleavage and their drawings by Alfred Des Cloizeaux (1845), approx. 0.14 carats each, 0.45 x 0.3 x 0.05 cm). Paris, MNHN, mineralogy, inv. H7054, 44.21Ea and 44.21Eb. Photos: © François Farges/MNHN.

Like Linné and Romé de l'Isle, Haüy inventoried many different forms of crystals. But he added that these crystals are formed by the superposition of an infinite number of identical “nuclei” that he names “*molécules intégrantes*” (integral molecule). According to precise rational laws that Haüy quantified, they form the basis of all other crystal forms, of a given species, even those that are dissimilar in appearance. Haüy associated each primitive form of a crystal with its “integral molecule” i.e., its chemical formula as understood by chemists at the time. His rational explanations laid the foundations for modern geometric crystallography, which is now based on similar principles, albeit very

different in substance (its "core" is a kind of ancestor of today's "unit cell" of crystallography that will be defined by his student, Gabriel Delafosse, in 1840). Please, visit my Haüy 2022 website (http://hauy2022.free.fr) to find out more (for safety issues, the direct link to my site is disabled in this document; please copy and paste the given address).

The star diamonds of Brazil

These inclusions (Figure 13) are fairly typical of Brazilian deposits (Rondeau *et al.*, 2004). Many gemmologists still call them "asteriated diamonds". However, this terminology should be reserved for a form of chatoyancy associated with microscopic inclusions of other minerals in epitaxy, such as rutile in corundum (star rubies and sapphires), but which exists in many other minerals (quartz, chrysoberyl, diopside, almandine, topaz, beryl, etc.) and is only revealed when they are polished as cabochons.

In contrast, this other type of inclusion – which I prefer to call petaled or stellar – can be seen in natural diamond crystals, which are at their worst cleaved or repolished on their octahedral facets (to make them transparent). In these diamonds, there is no chatoyancy linked to an optical phenomenon but a completely different singularity, linked to their crystallisation: their asteria is, in fact, what specialists call sector zoning. It develops when the sectors (set of facets) linked to the cube or octahedron grow simultaneously but with perceptible differences. In these particular diamonds, hydrogen is preferentially incorporated in the cuboidal sectors, while the concentration of nitrogen is higher in the octahedral sectors inducing a petal-like pattern. The darker appearance of cuboidal sectors is due to light scattering off disc-shaped inclusions that can be opaque or transparent and contain graphite (Howell *et al.*, 2013) hence their darker colour producing a stellar pattern. As well as conserving the first known example of a petalled diamond dating from the 19th century, that of Haüy, the MNHN recently (2014) received a gift from Geneva diamond dealer Serge Fradkoff of one of the largest crystals known (Figure 14) from Coromandel (Minas Gerais), which, like Grão Mogol, reminds Brazilians of the mythical diamonds from Golconda in India. For the sake of completeness, other stellar ("asteriated") diamonds have since been found, as in South Africa.

Figure 14 . One of the largest known petal-inclusion diamonds (12.20 carats), a natural octahedron with repolished faces recently extracted and emblematic of Brazil's Coromandel region (Minas Gerais). Crystal: 11 x 11 x 14 millimetres on a 19th-century display stand. Gift Serge Fradkoff, 2014. Paris, MNHN, mineralogy, inv. 217.3. Photo: © François Farges/MNHN.

6. The first recognition of black diamond

At that time, black diamonds were unknown in mineral collections, as shown by the large historical collections of Haüy, Romé de l'Isle, de Bournon and Louis XVIII held at the MNHN. However, some thirty years after Haüy's death (1822), mineralogical collections were enriched by another Brazilian diamond novelty: black diamonds, after jewellers had begun to facet them discreetly (this aspect will be discussed in more detail later in this book.).

Even today, black diamonds are still little-known to mineral collectors, as this term is mainly used by gemmologists and diamond dealers. Scientists call them carbonados because their nature and formation are not exactly the same as diamonds, as we shall see. However, to set the record straight, carbonado is dark brown to black in colour, virtually opaque, often highly reflective of light, rarely euhedral (forming crystals clearly defined by facets) but polymicrocrystalline (a compact assembly made up of a multitude of micro-crystals), which makes it very different from a standard jewellery brilliant. Like ballas and cuboids, the “black diamond” is most often a microcrystalline composite geomaterial, more precisely a rock. As mentioned earlier, some scientists even name it diamondite, following the example of quartzite, a rock essentially composed of quartz. The difference between mineral and rock lies essentially in the scale of observation: minerals are the components of the rocks that make up the bulk of landscapes in the form of rocks, cliffs, mountains and so on. To put it another way, minerals are to trees what rocks are to forests. Or houses in a city. So, we distinguish minerals from rocks because their respective properties are not identical, despite their similarities in composition: the dimensions and existence of a tree are not identical to those of its forest. Seen from the air, a natural forest area as far as the eye can see, such as the taïgas or the Amazon, appears to be homogeneously made up of trees that are often indistinguishable from one another. This is how a black diamond appears when observed by a specialist: a stone that looks homogeneous to jewellers, but which under the microscope reveals a fascinating mineralogical complexity that gives it a formidable interest that does not exist in gem diamonds.

Figure 15 . Five diamonds from a batch of eight (see the other three in Figure 163) together weighing 4.3 carats and found in the Chapada Diamantina (Bahia; Brazil) around 1850 in the very early days of their discovery. Their label reads (after translation from French) “amorphous diamond or / carbonate 5 karats ¾ to 10^{f} .57 *f* 50 / Bord [bort] 1 K ¼ to 14 *f*. 17^{f} .50 / diam.[on]^{d} c.[ristall]^{é} unsuitable for cutting 75 *f*”. Note, far left, a rare octahedral black diamond (6 mm edge) then four crystals of varying transparency and colour. Note the weathering of the ferrogallic ink which has pierced the paper at the level of the word “Bord” (bort). Paris, MNHN, mineralogy, inv. MIN000-2690 Photo: © François Farges/MNHN.

These black diamonds – which some call “carbon” and others consider unattractive because of their blackness, inclusions and opacity (Figure 15) – do not have the notoriety of pegmatite minerals with large, gemmy, coloured crystals such as aquamarines, topazes and tourmalines. Nor the popularity of the most coveted crystals from Alpine veins, such as rock crystal. Nor the beauty of crystals from metallic deposits such as pyrite with its golden reflections or malachite with its tender green and banded tones. They do not have the jewellery reputation of their gem equivalent, such as Liz Taylor's diamonds or those in monarchs' crowns. Who collects them, who knows about them apart from science museums and a few contemporary jewellers? They

are ignored in most historical works on mineralogy or jewellery. Even the famous diamond cartel of the De Beers mining company – which imposed a monopoly on diamonds from the mine to the jewellery during the 20th century (1930-2000) – was not interested in them (Herold and Rines, 2011; Herold, 2013). For many, black diamonds are to diamonds what emery is to corundum: massive, dark, polycrystalline aggregates that can only be polished, scorned and almost forgotten.

7. Already, some remarkable properties

Nevertheless, their resistance to the diamond grindstone is famous. Jacques Babinet (1794-1872), the father of an eponymous goniometer used to measure the angles of crystals, explains (1855, p. 814-815, translated from the French): "In a test carried out a few years ago at the expense of the French Academy of Sciences, a black diamond from Borneo, the hardness of which was to be tested, was given to the Gallais diamond cutter. He used a steel wheel and a large quantity of ordinary diamond powder on it without being able to make the slightest dent. The stone lost none of its roughness, although it was loaded with a considerable weight and then heated to white by friction, which caused sparks to fly from the steel wheel, which was put out of action. A few years later, the gemologist Streeter (1879, p. 61) recounted a similar story, but with a happier ending: "Black Diamonds of great beauty are occasionally supplied by Borneo. These are so adamantine that ordinary Diamond-dust makes not the smallest impression upon them; and they can only be ground or polished by using their own dust for the purpose."

Unlike emery, which has been known since ancient Greek times on the island of Naxos (Figure 18), this particular type of diamond was first discovered after 1844 in north-central Bahia (Teixeira et *al.*, 2005). Various mountain ranges do form the northern continuation of the Serra do Espinhaço in Minas Gerais (Figure 6). In the state of Bahia, the serras culminate at Pico do Barbado at 2033 metres and are made up of high plateaux of moderately high altitude. Some of them, notably the Serra do Sincorá, became famous in the 19th century for their diamond deposits, the *Lavras Diamantinas*, a name coined – in its cultural and imaginary sense – by the miners in search of gold and diamonds, i.e., those who actually cleared the land, opened trails and communication routes and then established settlements, these villages and towns in the making (Bandeira, 1997). However, the gem treasures of the state of Bahia are little known: no major Brazilian gem diamonds come from there and no famous mythical pegmatite with gem crystals is known there as it is for its large southern neighbour, Minas Gerais (however, see the last chapter). However, these two states have much in common geologically and were

historically explored since the 17th century for gold (as in Rio de Contas to the north of Brumado; Figure 6) and then, from the 19th century, for diamonds at Chapada Velha and then at the Chapada Diamantina.

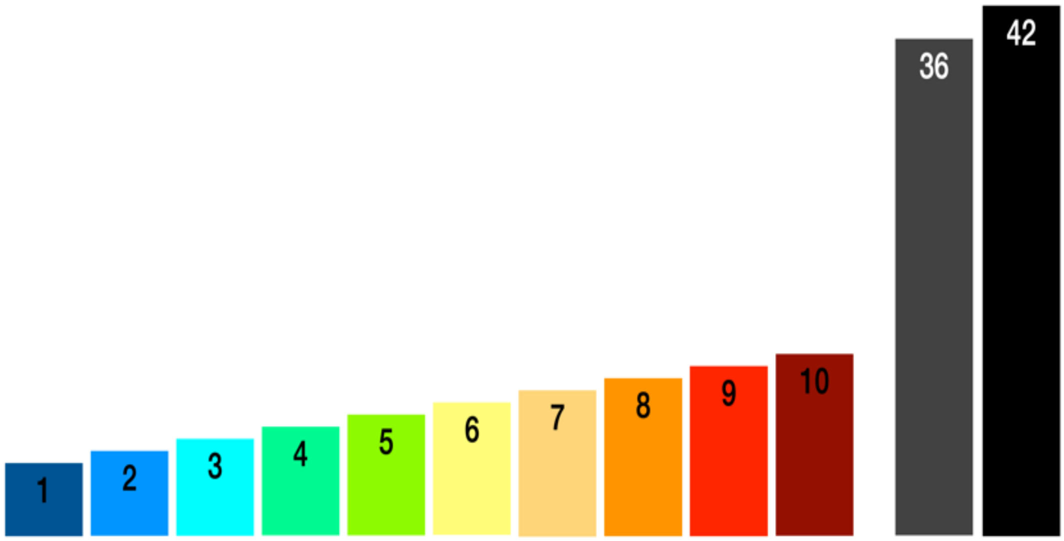


Figure 16 . Wooddell's (quite) empirical scale (1935) with the ten degrees of Mohs' (equally empirical) hardness scale for minerals: 1: talc; 2: gypsum; 3: calcite; 4: fluorite; 5: apatite; 6: orthoclase; 7: quartz; 8: topaz; 9: corundum and 10: diamond (monocrystalline). In black, the toughness of polycrystalline diamonds extrapolated in Mohs hardness: 36: carbonado and 42: ballas.

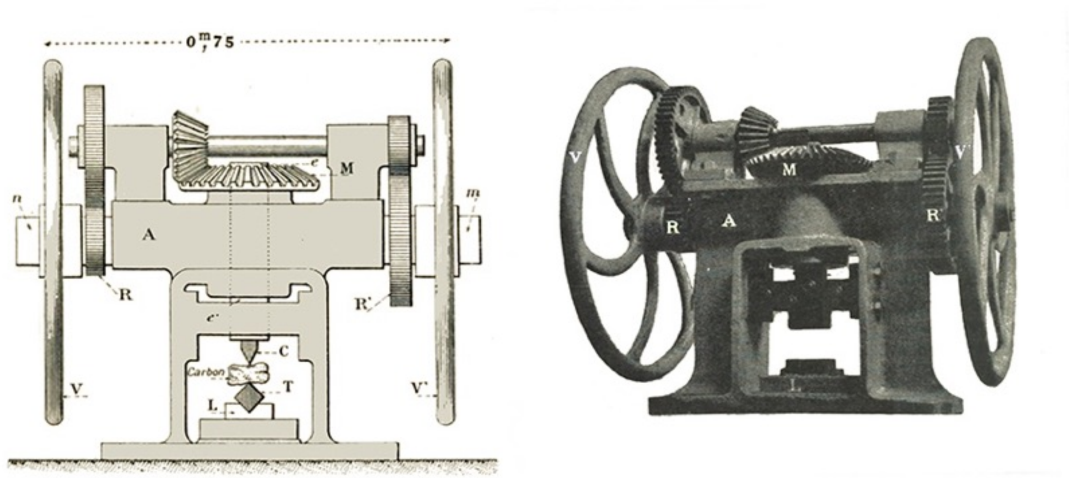


Figure 17 . The "Formholt machine" (diagram and construction) is a "carbon" shear developed to break "black diamonds" (carbonados) into fragments of a few carats. It was originally created by Félix (Jules Grégoire) Formholt (c.1863-?), the great Parisian stone-cutting specialist who also invented the diamond saw and wire, followed by a single-crystal diamond core cutter that was much more profitable, though less efficient, than the Leschot carbonados system. Similar machines, although modified for an even better efficiency, were later used by the garimpeiros of Chapada Diamantina (See Figure 55). Source: Escard (1914); credit: Paris, Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. 110.145.

Hardness versus toughness

We tend to confuse hardness with toughness: mineralogically, hardness applies only to homogeneous materials such as ruby or diamond. Black and colourless diamonds have the same hardness: 10 on the Mohs scale (Friedrich, 1773-1839, a German mineralogist who established the arbitrary basis in 1812). Toughness also measures a material's resistance to mechanical stress. It is therefore awkward to talk about the hardness of a rock, as we often do in everyday language. The combination of mineral hardness and rock toughness makes any polymicrocrystalline material particularly resistant to mechanical destruction: this is the case with black diamonds. Other examples of tough polymicrocrystalline rocks are jades, which are composed of less hard minerals such as tremolite and jadeite (5 and 7 on the Mohs scale, respectively). The physicist Charles E. Wooddell (1935) extrapolated Mohs' scale of mineral hardness into a scale of toughness, although the idea does not seem very rigorous by today's standards (Figure 16): if single-crystal diamond is set at 10, as Mohs assigned it, then carbonado climbs to a furious 36! And Ballas, because of its spherical shape, peaks at 42, which further increases its resistance to compression. This unusual combination of properties meant that carbonados and ballas were highly sought after for polishing gem diamonds, which are preferably monocrystalline (at most the simplest crystal twins of 2 individuals). They are also used for large drilling tools, including those used in mining (see the Leschot system below). These "black diamonds" are said to be unpolishable, but can be broken with enough effort: the old diamond apprentices used to spend gruelling days hammering them into the finest powder for their masters' grindstones. For about a hundred years, a manual screw shear known as a "Fromholt machine" (Figure 17) has been used to apply a colossal pressure of 15-20 tonnes per square centimetre (Haggerty, 2014), which breaks the carbonados into smaller blocks without pulverising them too much.

Figure 18 . On the left, the so-called emery rock (or corundite; height: 12 cm) from Naxos (Greece). It consists mainly of compacted millimetre-sized crystals of corundum, associated with minority crystals of hematite, spinel, etc.; on the right, various single crystals and gems of corundum in various colours, both natural (middle column) and faceted (34 carats in total, right column, England or France, late 18th to early 19th century), including the ruby and sapphire varieties (Sri Lanka, collection of King Louis XVIII). Like black diamantite (or carbonado), corundite tends to be dark brown. Conversely, corundite is not (yet) considered a gemstone, but because of its high hardness and toughness, and because of the existence of deposits in Greece, it has been powdered since antiquity to polish other precious stones. Photos: © François Farges/MNHN.

8. Bahian Diamonds

According to Guanaes (2001), there are two sub-regions within the Chapada Diamantina: the agropastoral region (west), which includes towns such as Seabra, Iraquara and Livramento do Brumado; and the historical or lavrista region further east, represented by towns such as Andaraí, Mucugê, Rio de Contas, Palmeiras and Lençóis. Within this historical Chapada, another subdivision distinguishes the "Chapada do Ouro" from the "Chapada do Diamante", which Guanaes (2001) identifies around two emblematic towns: Rio de Contas for gold and Lençóis for diamonds.

Figure 19 . "Visiting the mines": is the title of this colour postcard from the last century, which shows not only handsome gentlemen posing in their finery, but also the relationship between the miners stripping the soils and the retreating forest. Photo: © Roy F. Funch (photograph enhanced by the author from a postcard in the former collection of the late garimpeiro Mestre Oswaldo, *with permission*).

In the historic Chapada Diamantina, diamond mining requires running water to clean the gravel and concentrate the diamonds at the bottom of the pan, but also destroys the forests under which many of the deposits have been found (Figure 19). This region has historically had no significant electrical infrastructure, as it is located in a remote, mountainous area of the state of

Bahia, the Sertão region, a sort of Brazilian outback. This particular environment is described by climatologists as a "drought polygon" within the Brazilian Plateau, the mountainous hinterland that stretches from the north to the south of Brazil.

Figure 20 . On the left, the *caatinga* in the dry season ("white forest") in October 2016 (Serra das Letras, Flores, Pernambuco) and, on the right, in the rainy season (January 2015) when the clouds are stopped by the relief of the Chapada Diamantina: here, the Três Irmãos (Three Brothers) on the western slope (north of Palmeiras). This climatic change re-greens the caatinga below and feeds an important network all around these mountains, encouraging the growth of a tropical deciduous rainforest in its area. Photos: Geziel Amaral (Creative Commons Attribution-Share Alike 4.0 International licence) and TontiTonti (Creative Commons Attribution-Share Alike 3.0 Unported licence).

The sertanejo landscape, or sertão, is covered in its original state by adapted vegetation, the caatinga, made up of low, thorny bushes adapted to this extreme climate, such as the cashew tree (*Anacardium occidentale*). However, much of the vegetation in the Sertão is gradually being degraded as a result of centuries of cattle ranching and cotton farming. But the Sertão region has more than one facet: in his collection of memories of his 1938 expedition to Brazil, entitled "*Tristes tropiques*", the anthropologist Claude Lévi-Strauss (1955) explains that "the sertão refers to a subjective aspect: the landscape in relation to man". In this way, the sertão - like the *Lavras diamantinas* - also refers to an individualised culture, the fruit of Portuguese colonisation and tinged with indigenous influences, especially the Tupi-Kawahib cultures. The resulting cross-fertilisation - the community of caboclos, built as much on sweat as on blood - also helped to counterbalance the power of the large planters, the fazendeiros, that prevailed along the Atlantic coasts, where the large cities (Recife, Salvador, Rio de Janeiro, São Paulo, etc.) sought to establish their power on a more clearly Europeanised model.

While the climate of the Sertão is semi-arid, the main mountains of the Chapada Diamantina, such as the Sincorà, are much wetter (Figure 20). However, due to its location at the eastern foot of the mountain range, which acts as a rain barrier for the region, the town of Lençóis and its immediate surroundings are much wetter. Tropical rains are common during the rainy season from November to April. During the dry season, from May to October, the climate is the opposite. There have even been catastrophic floods and, on the other hand, deadly droughts, such as that of 1877-1879, when half the population of the area died of starvation.

As a result, the diamond economy developed in parallel with the seasonal constraints, as did agriculture, which, in this atypical sertanejo refuge linked to the Chapada Diamantina, benefited from an influx of favourable, albeit transient, water. In fact, these water flows are the origin of the diamond deposits: the erosion, dissolution and drainage of the mountain rocks allow the diamonds to remobilise while escaping the destruction often promised by these atmospheric agents. Only quartz, a few other silicate minerals and, above all, diamonds are able to withstand them, thanks to their chemical resistance

(durability). Together they are carried by the flow of water. Feldspars and other micas, on the other hand, have long been weathered into clays and iron oxides, and then leached out to form oxisols, characterised by extensive weathering of the underlying parent rock. Such soils are enriched with aluminium and iron oxides: commonly known as "laterites" and brick coloured, they are *terracotta* coloured laterosols that contrast with the green of the *caatinga* in the wet season (known as "white" or "grey" forests in the dry season).

HISTORICAL BACKGROUND

1.The *Bandeirantes* and the Brazilian Eldorado

The exploration of Brazil's interior began as early as the 18th century with the incursions of the *bandeirantes*, literally 'those who follow the flags'. These Lusitanian conquistadors are curiously less well known outside the Portuguese-speaking world. Hispanic colonisation of South America. With similar motivations, the *bandeirantes* are usually the offspring of European and indigenous settlers in search of gold and silver, as well as natives to enslave. Along the way, they capture up to 50,000 indigenous people and decimate their crops (Bueno, 2003). In addition, the mountainous hinterland, which today corresponds to the Espinhaço mountain range and stretches between Minas Gerais and Bahia, was relatively depopulated (Castelnau, 1850). This lack of labour led to the mass deportation of Africans from similar climatic regions, such as Nigeria. Like the indigenous peoples of the Americas, these young, robust slaves endured, as best they could, the coercion of forced mining in an equatorial climate.

In fact, native gold was discovered in many places in the rivers of the Taubaté hinterland near São Paulo as early as 1697 (Bueno, 2003). As the rivers flowed upstream into the regions of Mato Grosso, Goiás and Minas Gerais, including the São Francisco River, other increasingly productive deposits were discovered in the fluvial alluvium that led the explorers upstream. The precious metal quickly accumulated, from a few kilograms to many hundreds of tonnes. The centre of the gold rush was Vila Rica, later renamed Ouro Preto (litterally "Gold Black") in the Minas Gerais region. This kind of Eldorado, so much dreamed of by the Spanish conquistadors, was more geological in nature, with diamonds hidden here and there in the gold-bearing gravel! This gold rush, known in Portuguese as the *corrida do ouro*, was the first and longest in the world, but paradoxically one of the least known (Boxer, 1969). It produced 800 tonnes of gold in the 18th century alone, not counting smuggled production. These stratospheric figures contrast with the hundred or

so tonnes of gold extracted by the conquistadors over three centuries, which some specialists, including historians, still consider to be the main source of colonial gold in South America.

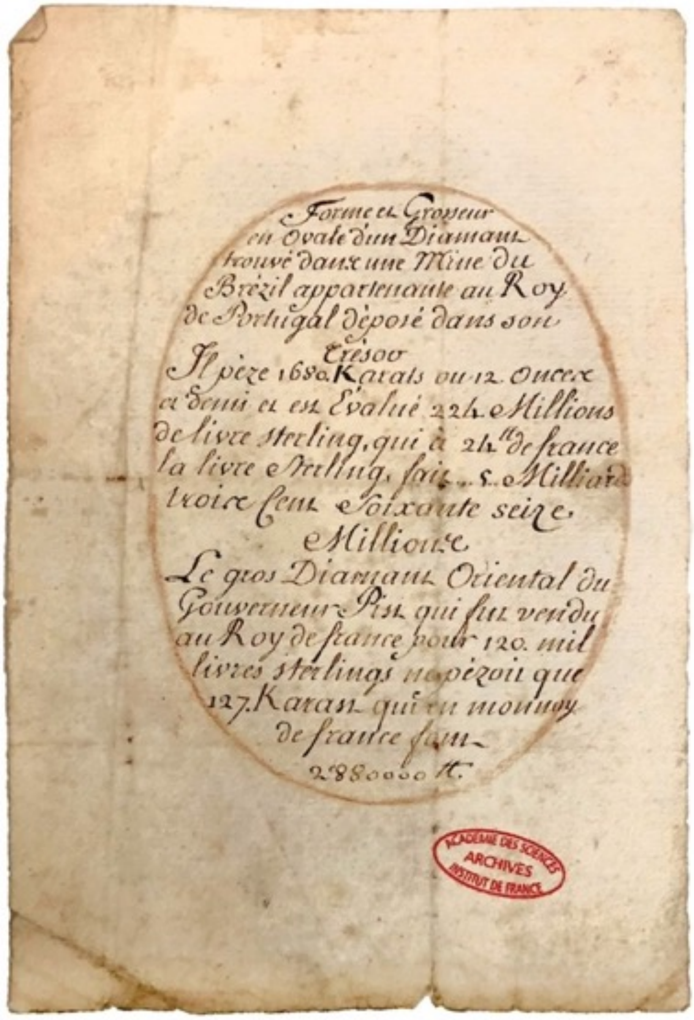
Figure 21 . Louis-Michel van Loo (foreground) and Joseph Vernet (background): portrait of the Marquis of Pombal (1766). This figure played a major role in Portugal's economic development, in the construction and reconstruction of several important buildings after the earthquake of 1755 (plans on the right), and also in the expulsion of the country's Jews (background). Collections of the Câmara Municipal de Oeiras. Source: Wikimedia Commons (via almada-virtual-museum.blogspot.com/2017/07 and via www.oeirascomhistoria.pt; CC-PD-Mark, public domain), cropped (out of frame).

So much so that, on 4 October 1732, Vasco Fernandes César de Meneses, Count of Sabugosa (1673-1741) and Viceroy of Brazil (1720-1735), banned diamond mining in the Bahia region (Prado Jr., 2011), not only to avoid overproduction of gems that would damage the Crown's profits, but also to prevent mining from ruining agriculture, which was the other basis of income for the Portuguese aristocracy in Brazil. This was later confirmed (Castelnau, 1850) by the head of the royal government, Sebastião José de Carvalho e Melo (1699-1782), Marquis of Pombal (Figure 21). In the course of the 18th century, the Portuguese Crown was enriched with at least three great diamonds that eclipsed its earlier European rivals: The Great Diamond of

Portugal (yellow, oval, 1730-906 carats, no longer extant), the Regent of Portugal (also known as the "Abaéte", natural, 215 or 135 carats depending on the source, the second stolen in 2002) and, according to Casquilho (2020), the one that would come to be known in the United States as the Portuguese Diamond (brownish-yellow with bluish fluorescence, octagonal, emerald cut, 127 carats, although it is documented elsewhere as coming from South Africa; Balfour, 2008).

Figure 22 . Maurício José do Carmo Sendim (1786-1870): Portrait (c. 1830) of the teenage Queen Dona Maria II of Portugal - Domingos Sequeira (1768-1837): Portrait (c. 1820, detail) of Prince Regent John, future King as Dom João VI of Portugal). According to Casquilho (2023), the Queen wears Portugal's Great Diamond, the Bragança, cut to 906 carats, under her left hand (see the insets below right for details of these objects). However, it could be a gold plaque of the Três Ordens of Portugal, as it is tied to the cord of this order worn as a sash (a second portrait of the Queen by this painter shows a similar object, the plaque of the Royal Order of Saint Isabella of Portugal). An earlier portrait of the Prince Regent (right) clearly shows a similar object (detail in inset) with a gold-set diamond surround and hoop. Oil on canvas, 94.5 x 72.5 cm and 131.5 x 111.5 cm; Lisbon, National Palace of Ajuda, inv. 56514 and 4115. Credits: Luísa Oliveira-João Silveira Ramos/© DGPC, Wikimedia Commons (CC-PD-Mark, public domain).

2. The Braganças


Forme et Grosseur
en Ovale d'un Diamant
trouvé dans une Mine du
Brézil appartenante au Roy
de Portugal déposé dans son
trésor
Il pèze 1680. Karats ou 12. Onces
et demi et est Évalué 224. Millions
de livre sterling, qui à 24.ll de france
la livre sterling, fait... 5. Milliards
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Le gros Diamant Oriental du
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Figure 23 . Outline of the Brazilian diamond known as the Bragança (which has now disappeared), the text of which reads (after translation) "Shape and size in oval of a Diamond found in a Mine of Brazil belonging to the King of Portugal deposited in his Treasury/It weighs 1680. Karats or 12. ounces and a half and is Valued 224. Millions of pounds sterling, which at 24. livres of France per pound sterling, makes 5. Billions three hundreths seventy six Millions/The large Oriental Diamond of Governor Pist [sic!, Pitt] that was sold to the King [of France] of for 120. thousand sterlings is weighting only 127. Karast [sic!] that is, in France currency, 2880000 livres". Drawing (101 x 68 mm) and text copied from the Journal Œconomique (vol. 7, 1751, pp. 141-144), which includes errors (such as the Regent's weight, which is missing 10 carats). Paris, Institut de France, Archives de l'Académie des sciences, fonds Réaumur, 62 J; cliché and communication: Frédéric Blanchard, 2023.

The example of the Great Diamond in Portugal (Figure 22) – later known as the *Bragança* (Braganza) – is striking: discovered in Minas Gerais around 1741 (Casquilho, 2023), this huge diamond of 1,680 (old) carats is the size of "a hen's egg" according to the *Journal Œconomique* of July 1751 (Figure 23). This publication describes the enormous value of such a gem in livres

tournois, the French monetary unit of the time. It would be worth... 5 billion livres tournois (although it is risky and debatable to try to convert such a sum into today's value - because of inflation and the relative value of goods, which has changed since then - we can estimate it at around 50 billion euros today, although this figure means little). This is an infinite value compared to the price of the French Regent diamond (140.62 carats), to which it is compared and which is worth "only" 2,880,000 livres tournois. The stratospheric value announced for the Bragança by the Journal Œconomique is in fact highly exaggerated: on the basis of the charter of the merchant Tavernier (1676), this diamond was worth at most "only" 430 million pounds (about ten times less than announced). And because it is dark yellow (Casquilho, 2023) - which is (very) badly perceived (Tavernier, 1676) - its value falls to 250 million livres tournois at best (if the stone were pure and colourless, etc.). Since the disappearance of the gemstone at the beginning of the 20th century, writers have been reduced to speculation, which has fuelled the myth.

The Great Diamond of Portugal or the Bragança

This diamond is so mysterious that its very existence is disputed. The French physicist and naturalist René-Antoine Ferchault de Réaumur (1683-1757) recorded its outline and various financial rumours, which he copied from the July 1751 issue of the Journal Œconomique (I would like to thank Frédéric Blanchard for providing me with this unpublished document (Figure 23). Other experts since the 18th century have claimed that it was a colourless sapphire or topaz, or even an aquamarine (see the excellent summary in Casquilho, 2023 and its references). This author attempts to prove the existence of this diamond, which is said to have been found in Minas Gerais in 1741 and given to King D. João V of Portugal (1689-1750). Yellow in colour, it weighed 1680 carats (in old Lisbon carats, karat), equivalent to 1721 carats today (Dourthers, 1840; Carrara, 2005). Three elongated but largely dissimilar contours are known (Balfour, 2008; Casquilho, 2023). On average, these different sources describe an ovoid stone measuring approximately 105 x 68 millimetres (mm). It was recut in the first half of the 19th century to a size of 867 carats (approximately 906 carats), with "few facets".

According to Casquilho (2023), a portrait of Queen D. Maria II of Portugal shows the gem (Figure 22). According to this suggestion, my simulation (DiamCalc software) shows a gem (about 95 x 60 mm) that is relatively thin in relation to its size, about 15 mm, which corresponds to a "portrait diamond" (a relatively thin slice of diamond). However, its yellow colour makes it impossible to set a painted miniature on the back (hence the name "portrait diamond"), except with a gold paillon, which only enhances the bright and yellow colour of the jewel. The latter is enriched with about 24 colourless or nearly colourless peripheral cushions, each weighing about 2 carats (according to DiamCalc), which serve to enhance the brilliance of the whole.

In fact, in this type of (commissioned) portrait, the ornamentation is painted afterwards in the workshop from memory or from a quick sketch, and the artefacts are often exaggerated (Farges, 2014), especially as the overall execution by Maurício José do Carmo Sendim remains particularly clumsy. To me, the painted jewel appears oblong, flattened, shiny and gilded: it could also be the cordon plate of the Three Orders (*Banda das Três Ordens*, i.e. those of Christ, Avis and Sant'Iago) worn by Portuguese monarchs at the knot of the cordon since 1789. Since the latter is painted as being worn in a sash, the plaque must also have been visible.

3. Abundance and suffering

Nevertheless, these exorbitant values illustrate the enormous financial impact of the diamond discoveries in Brazil on the Portuguese crown. Used as collateral by the Crown's financiers, the Bragança diamonds would never have found a buyer at this price. Cut into a few large gems and a multitude of smaller ones, it could have been sold at a lower price. But this would have led to a dramatic fall in the price of gem diamonds (Casquilho, 2023). It should not be forgotten that Portugal was then flooding Europe with Brazilian diamonds, which contributed to chronic price instability for several years. To give an idea of the wealth produced, Pereira (1909) states that during the Portuguese colonial period, 12 million carats were produced and sold, including through smuggling, equivalent to two and a half tonnes of diamonds. This was the dilemma of the Portuguese monarchs, who became too rich one day and too poor the next, following the example of the Spanish Crown, which a century earlier had gone bankrupt because of the inflation caused by the abundance of gold and especially silver from the mines of the Americas.

Although Lisbon feared overproduction - Minas Gerais was a huge producer - Bahia's fazendeiros were not very keen on diamonds because of the royal monopoly on the mineral. Any owner of lucrative land - including a gold mine - lost his property to the Portuguese Crown if a single diamond was found (Hoffmann, 1828). However, diamonds were reported as early as 1755 at Jacobina (Figure 6) northeast of Bahia (Castelnau, 1850). Many of these gems were mined clandestinely from the 1730s onwards and supplied clandestinely to the Minas Gerais industry or exported unofficially. Many authors (Svisero et al., 2017; Teixeira, 2021) estimate that unofficial production in Brazil, all states combined, is of the same order of magnitude as declared production. As a result, the price of diamonds in Europe is struggling to keep up, which means that the authorities are closely monitoring these smuggling operations.

More generally, the colonial harshness of the metropolis - including the over-exploitation of Minas Gerais' mineral resources - led to a revolt in 1789, the *Inconfidência Mineira* (Mineira's Discontent), against the excessive taxes and restrictions imposed on the Portuguese colonists born or settled there.

Although very different, this uprising was also reminiscent of the one that led the thirteen British colonies in America to declare their independence in 1776 and form the federation of the United States of America, which was recognised in 1783 by the Treaty of Versailles following the War of Independence (1775-1783).

Figure 24 . Detail of the Central-Northern Bahia Diamond Zone (hatched according to Funch, 2022) with the main localities (in black and bold), the diamond localities mentioned in the text (in black and italics) and other mines of mineralogical importance (⚒). In green, the Chapada Diamantina National Park; in brown, the various *serras* mentioned here; in blue, the main rivers, including the diamond-bearing rivers (dark blue); in red/orange, the main roads (primary/secondary). Redrawn and captioned by the author on the OpenStreetMap France topographic relief (under Creative Commons BY-SA 2.0 licence).

On the Brazilian side, the conspiracy was betrayed internally and then bloodily put down by the Portuguese royal authorities under Queen Dona Maria I of Portugal (1734-1816). Many mining families, including patricians and their slaves, emigrated further north to the state of Bahia (Figure 24), into the sparsely populated and remote mountainous areas, to escape this fierce repression.

Figure 25 . José Leandro de Carvalho (1770-1834): Portrait of King John (D. João) VI of Portugal, the Algarve and Brazil (circa 1818). The sovereign wears an impressive insignia (of the Order) of the Golden Fleece (see Figure 66), as well as the cordon of the Três Ordens and various badges of other military orders.. Rio de Janeiro, Museu Histórico Nacional, inv. 469. Credit: © Museu Histórico Nacional, Wikimedia Commons (CC-PD-Mark, public domain).

4. The serranos

Among the dynasties of patricians who sought refuge in this remote part of Bahia, where the law was still timid, two particular families would stand out in this saga. The first, the Gomes de Azevedo, is said to have descended from a prestigious family of settlers of northern Portuguese origin from the Braga region, who emigrated to Brazil in the 1780s. The grandfather, *Comendador* (Commander) Domingos Gomes (da Costa) de Azevedo (1740-1831), is also known as Capitão (*Captain*; Aguiar, 2019): he is the first of this name to be archived in Brazil. For the sake of clarity, he is referred to below as "(I)" because of the numerous Domingos in this family. In 1789, Domingos (I) emigrated from his birthplace in Arraial do Tejuco (now Diamantina), Minas Gerais, to escape the fierce royalist reprisals against the aforementioned Mineira conspiracy (Teixeira Cotrim, 2014). Finding refuge in Caetité, in southern Bahia, he took an active part in local politics, where his siblings were locally nicknamed "*Bragança*" or "*Familia Real*" (Braganza or Royal Family; Santos, 1997), referring to the Royal House of Bragança, which ruled Portugal, Brazil and the Algarves, as explained above. There may even be a reference to the eponymous diamond mentioned above.

The Gomes de Azevedo family supported the War of Independence (from the yoke of Portugal, 1821-1824), which served the interests of these patricians and sounded like a final revenge for the persecutions of the metropolis under the reign of John VI (João, 1767-1828), nicknamed "the Clement" (Figure 25). For its part, Portugal had to repay British military and political aid after the Napoleonic wars, but received financial compensation from Brazil for its independence, declared in 1822 and finally recognised in 1825. As a result, the King of Portugal, Brazil and the Algarve - Dom Pedro IV (1798-1834) - became the first Emperor of Brazil under the name of Dom Pedro (later, Dom Pedro I, Figure 26) and abdicated the throne in Lisbon a few months later.

These "independence diamonds" not only paid the interest on the emperor's loans to British banks, but also Portugal's debt to Britain for its armed and political support against France and Spain (Casquillo, 2023). Jacobs

and Chatrian (1884, p. 154) elaborate: "At the beginning of the nineteenth century diamonds were shipped directly from Rio de Janeiro to Amsterdam. As a result of the British protection the country enjoyed during the Napoleonic Wars, a ten-year exclusivity agreement was concluded between Portugal and the United Kingdom, and more specifically with Hope & Co. based between Amsterdam and London. Lisbon agreed to sell natural diamonds to Hope & Co. at an average price of 1.82 £ per carat. And Hope & Co. resold the cut diamonds at ca. 7 £ ! This was a margin rarely achieved by diamantaires. But this new and sudden avalanche of diamonds caused prices to fall again (Cattelle, 1911). This left the Portuguese crown in a disastrous financial situation, as the mines were still producing too much for the profits they were making (Jacobs and Chatrian, 1884, p. 100).

Figure 26 . Simplício Rodrigues de Sá (1785-1839): Portrait of Emperor D. Pedro I of Brazil (circa 1830). The monarch is wearing an insignia of the Order of the Golden Fleece, reminiscent of that on the crown of Portugal (See Figure 25 and Figure 63). He is also wearing six plaques from various orders of chivalry, some of which are richly set with small diamonds, which must be Brazilian. Petropolis, Museu Imperial. Credit: © Museu Imperial, Wikimedia Commons (CC-PD-Mark, public domain).

On the Brazilian side, the Gomes de Azevedo family welcomed the establishment of the Brazilian Empire in 1822, although the imperial authorities in Rio de Janeiro remained distant and even suspicious. It imposed a centralised constitution from 1824. In fact, any imperial system, which essentially unites and governs different peoples, de facto mistreats the different cultures it is supposed to protect. Nevertheless, the state of Bahia joined the Brazilian Empire in 1824, after separatist movements in the North-East (Pernambouc, Piauí, etc.) had been suppressed in the same year.

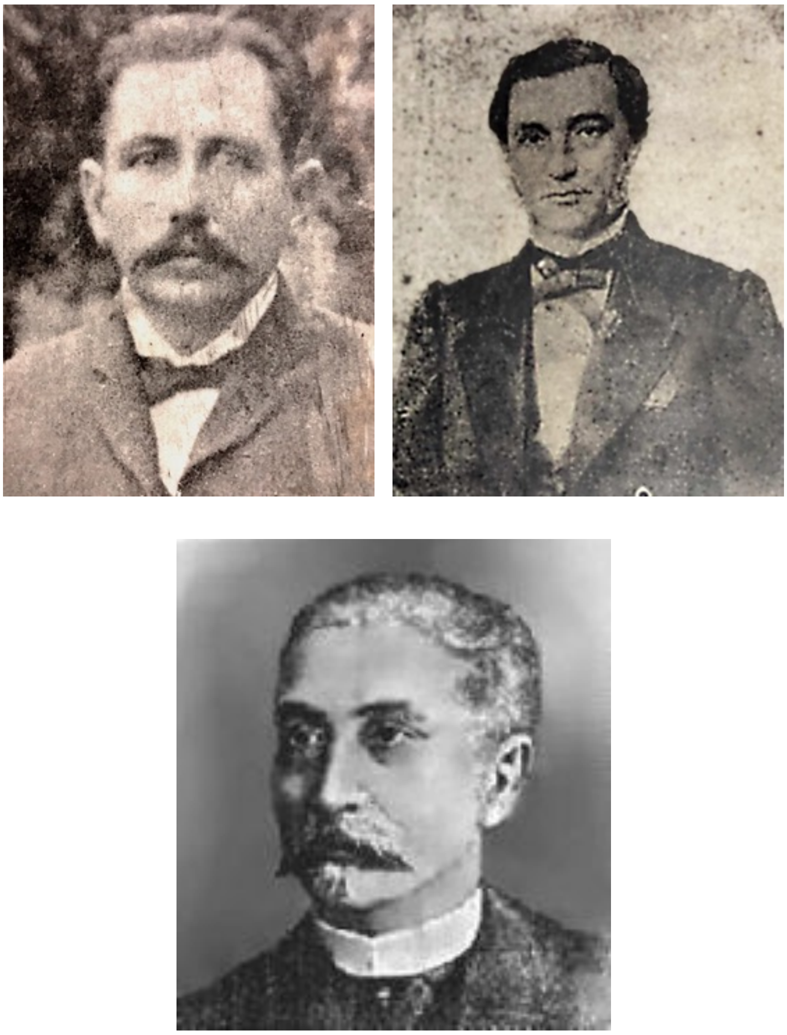

Figure 27 . Portraits of the Bahians mentioned in this essay are rare: on the left, José Venâncio Gomes de Azevedo (great-grandson of Capitão Domingos I and grandson of Joaquim Venâncio); centre : Antônio Souza de Spínola (step-great-uncle of the previous and uncle of the next); on the right: (Aristides) César Zama, son of Aristide (Cesare) Zama. Credits: Romulo Azevedo Rocha (first and second images, digitally optimized by the author); André Koehne (Wikimedia Commons).

In Caetité, Domingos and his sons, including Joaquim Venâncio (c. 1789-1846), were recognised as "*gente de qualificação, polida tal qual os diamantes que possuíam em suas bagagens*" (people of quality, polished like the Minas Gerais diamonds they had in their luggage; Aguiar, 2019). They became immensely wealthy through cotton farming and the banking activities of Azevedo e Irmãos (Azevedo & Brothers). Like other patrician fazendeiro families, they had a strong sense of caste and property. They married and worked as a family or allied themselves with the few other families of the same rank. They often kept the same forenames and their genealogy is confused in retrospect. For example, Joaquim Venãncio's two sons from two successive marriages (Virginia Soriano and Maria Roza de Azevedo) were christened Domingos (for the sake of clarity, he is referred to as "II", 1810-1840; Teixeira Cotrim, 2014) and Domingos ("III", 1838-1915) respectively. The latter's date of birth, often given as 1810 due to confusion with his elder son, is recalculated on the basis of Pereira's (1937) statement that he was 11 years old in 1839. Furthermore, portraits of all these people are rare (Figure 27).

Not to be outdone by the ladies were the Spínolas, another patrician family from Caetité, said to be descended from Portuguese settlers from Madeira. Note my cautious affiliation, as I have not been able to formally confirm that they were in fact descended, as Santos (1997) claims, from an exiled branch of the prestigious Spínola family of Genoa, which produced a number of local doges. The Brazilian Spínola were attracted to gold mining in Rio de Contas, a town north of Brumado and not far from Caetité, in the 17th-19th centuries (Figure 6). Their wealth was considerably increased by the sale of four tonnes of local gold in London. Santos (1997) further explains that the young Rita Angelica Souza Spínola (c. 1802-?) married Antônio José da Silva Soriano (c. 1797-1834), whose health was rapidly deteriorating due to tuberculosis. Grieving at the bedside of her dying young husband, Rita Angelica sought medical help from the doctor Aristide Zama (1798-1840), an Italian political refugee whom the Brazilians called Cesare or César. This native of Faenza - whom I found in the Italian archives as a surgeon in Argenta, in Emilia-Romagna - emigrated to Brazil in 1838, following in the footsteps of Giuseppe Garibaldi (1807-1882), who had been exiled to Rio de Janeiro

because of his liberal, revolutionary and anti-monarchist sentiments, then suppressed in northern Italy. In reality, the *gentile dottore* is a sulphurous alley cat, in the quarrelsome, confused style of *Don Giovanni*: he comforts the inconsolable young Doña Rita Angelica, who is so rich and powerful. She discreetly remarries her *caro dottore* - O misalliance! - and gave birth to her son, Aristides César Zama (1837-1906; Figure 27 right), despite the general opprobrium of the patrician men, fathers, brothers, uncles, cousins and priests. In the end, the doctor was murdered by one of his wife's slaves, a man called Antônio. Sentenced to death, he justified his murder by saying (Santos, 1997): "*morro satisfeito porque tirei uma onça do pasto*" (I die satisfied because I caught a jaguar in the pasture). A side question: who really benefits from Antônio's crime? (my opinion has already been suggested above) After the death penalty was carried out, a sense of injustice spread throughout Brazilian society, from the interior to the Atlantic coast, leading to widespread slave revolts that eventually forced the abolition of slavery in 1888 through the *Lei Áurea*.

In short, the fertile progeny of these families, a dozen at the very least per marriage, means that they have to make the family fortune grow in as many ways as possible to avoid impoverishment through testamentary division (not to mention the dowries of future wives). Any new commercial and financial opportunity is carefully monitored, especially as these families employ financial experts to prospect for any new lucrative outlet they can invest in.

5. The Empire's first Bahian diamond

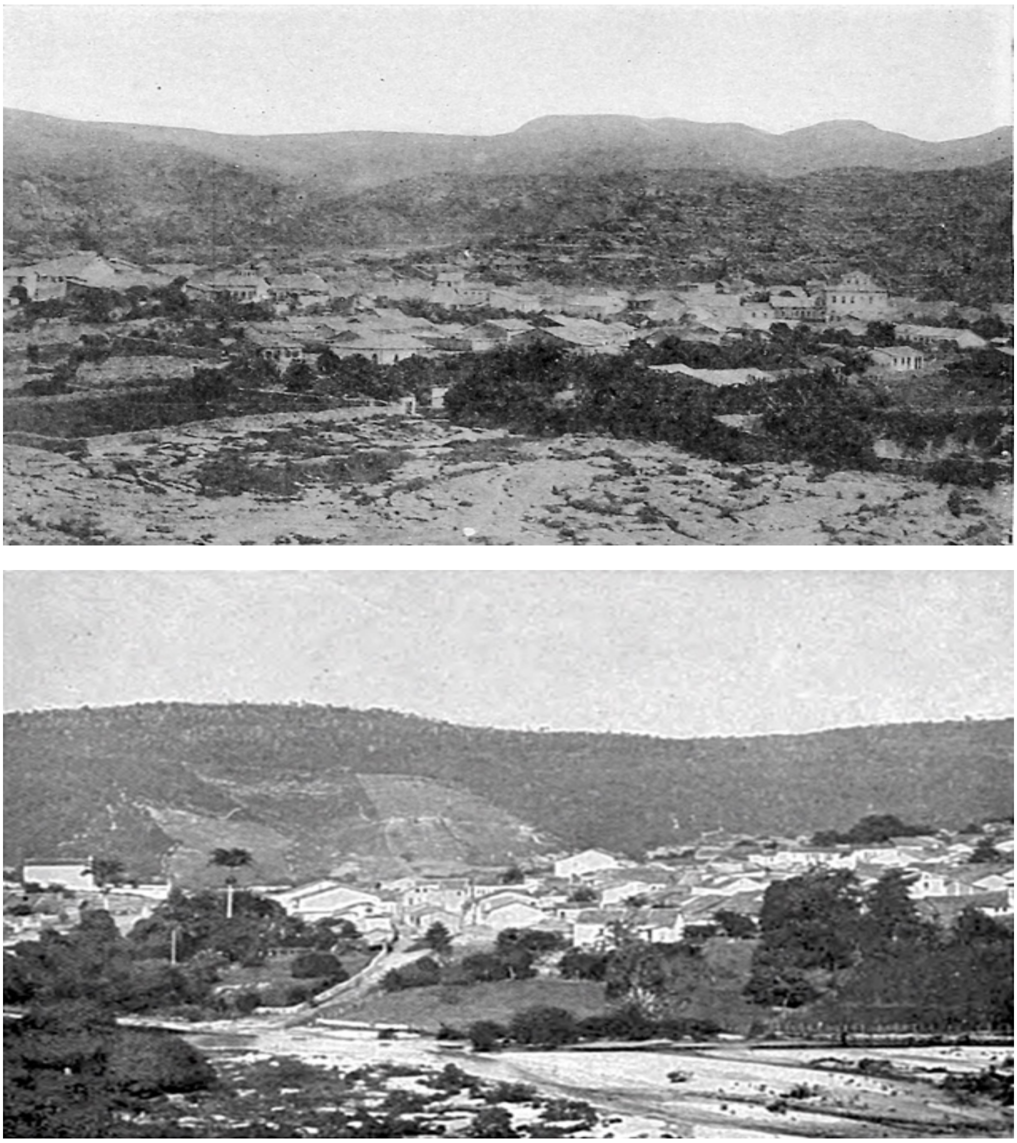

Figure 28 . Views around 1900 of the two urban centres of Santa Isabel do Paraguaçu (later Mucugê, seen from east to west) and Vila dos Lençóes (later Lençóis, seen from west to east, with the church of Nosso Senhor dos Passos on the left). Sources: O. Derby (1906, p. 402; 1907, p. 218-219) / The Biodiversity Heritage Library.

Meanwhile, two Bavarian naturalists, who had followed Alexander von Humboldt, travelled through the region: Johann Baptist [von] Spix (1781-1826) and Carl Friedrich Philipp von Martius (1794-1868) explored the Bahian serras of dos Lages (towards Morro de Chapéu) and Sincorá (around Mucugê; Figure 28). In 1822, these two authors (Spix et Martius, 1828, p. 442) reported

the presence of diamonds: "... *eben so in der Provinz Bahia nächst der Villa do Rio das Contas und auf den benachbarten Gebirgen von Sincorâ* [sic!] *und Lages, wiewohl sehr spärlich, haben entdeckt*" (... also in the province of Bahia, near the Villa do Rio das Contas [today' Rio de Contas], and on the nearby mountains of Sincorá and Lages, albeit rarely). This implies unofficial mining within gold placers.

Borges de Barro (1917) explains that diamond mining began in Bahia following the law of 25 October 1832, which authorised it. However, the opposite is obviously true, as this law was more of a framework for an established practice in order to collect taxes. In reality, the diamond fields belong to the State of Bahia, which leases small plots to independent miners or large concessions to landowners (or their consortia). Catharino (1986) lists the diamond garimpos already operating in the region, without forming a "mining basin": in the Serra de Gagao in 1817, then in those of Sincorá and Lages in 1821, 1839 (or 1834), in Tamanduá in 1939, in the Serra do Assuruá in 1840, in Santo Inácio in 1841, in the Serra das Aroeiras in 1842, etc. In short, there was a new abundance of diamond mines in the region.

Officially, José de Matos (or Mattos), an *alferes* (ensign) who had worked in the mines of Diamantina, in Minas Gerais, and who had arrived via the São Francisco River, had been looking for gold in the Serra do Assuruá, a mountain range (serra) in the Chapada Velha, since 1841 (Figure 24). He found gem diamonds around 1842-1843 near Cotovelo, some twenty kilometres north-west of Gentio do Ouro. Others were found around Brotas de Macaúbas, a little more than a hundred kilometres to the south (Banaggia, 2019). The Bahian fazendeiros, who were also senators or deputies, warned the emperor of the serious damage to their farmland, following the lead of the Marquis of Pombal in the 18th century. Immigration was threatening to flood in, as the diamond deposits in Minas Gerais were producing less and less (Burton, 1869), leaving a large number of miners unemployed and even destitute (Martins, 2013), including their dependants (grocers, landlords, transporters, moneylenders, etc.). In vain: from 2,000 souls in 1845, the population of this region increased to more than 5,000 in 1849 (de Castelnau, 1850) and 40,000 in 1871, representing up to a third of the population of the state of Bahia (Martins, 2013).

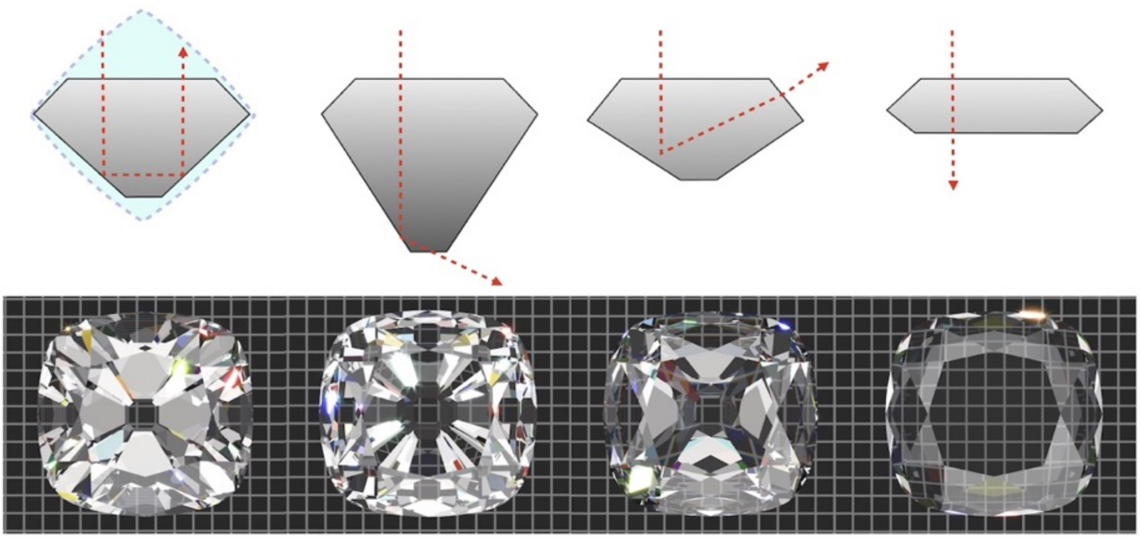

Figure 29 . Diagrams illustrating the influence of the thickness of a diamond seen in cross-section (above), in which light propagates (red dashed lines), compared with the optical representation of the same diamond seen normally (above via photorealistic simulations with DiamCalc, dimensions: 10 x 10 mm). The square background helps to detect miscuts. From left to right: a natural diamond crystal historically considered thick (blue background) and its faceted equivalent (grey background), which currently corresponds to an ideal thickness for a diamond cutter; then a similarly faceted gem considered too thick; then another too thin; and finally the extreme case of a portrait diamond (cleavage blade with a glossy edge showing through to a miniature placed underneath). Drawings and simulations by the author.

Other discoveries were quickly identified by this 'immigration of skills' from the Mineiros, based on the knowledge previously built up at the Diamantina or Grão Mogol mines. Other placers further south, 300 kilometres to the south-east and on the other side of the Serra do Sincorá (Figure 24) were identified as early as June 1844 by three locals said to have come from Chapada Velha: José Pereira do Prado, known as Cazuzinha do Prado, accompanied by his son (or, depending on the version, a godson called Cristiano Nascimento) and Pedro Ferreiro, a slave (alternatively known as "partner"; Alma Toldeo, 2008; sometimes these qualifications are compatible, especially when the slave becomes an influential éminence grise to his master). What may be a similar understanding in Portuguese: the garimpeiros refer to a mineral found in association with diamonds ("diamond partnership or associate") as cattivo (captive) or escravo (slave). According to Toldeo, who has scientifically cross-checked the various historical versions and corrected the many versions that have since been published, the slave/associate of the so-called "humble

Cazuzinha" discovered two diamonds, one and four carats each, in the river that flows through the village of Mucugê do Paraguaçu, shortly afterwards renamed Santa Isabel do Paraguaçu (now Mucugê; Figure 28). They returned with fourteen trustworthy garimpeiros and excavated 8 *oitavas* (about 28.7g) of so-called "thick" diamonds. This adjective is of crucial importance to the miners here, but has rarely been mentioned by historians, as explained in the box with its Figure 29.

Thick diamonds

These so-called "thick" diamond crystals reflect a peculiar double terminology used by diamantaires to refer to natural faceted crystals ("rough"). These particular crystals - most often octahedrons and rhombododecahedrons - are relatively thick in relation to their extent (width-length; Figure 29). A naturally thick diamond can only produce a gem of maximum brilliance after faceting if its final thickness is neither too great nor too small: the light travels deep enough to be reflected by the facets on the back (the so-called pavilion) and to return to the observer, multiplying the fire and brilliance of the gem. Conversely, a faceted diamond that is too thick will enhance undesirable optical effects (Figure 29); if too thin, the stone can behave like a pane of glass, allowing light to pass through rather than reflecting it. In short, thick natural diamonds are sought after for faceting (but not too thick, otherwise the losses during faceting will be too great, resulting in a decrease in rentability).

Mogul India historically produced both thin and thick diamonds, but reserved the latter for its emperor when the stones weighed more than (approximately) thirty carats (Tavernier, 1676). As a result, Europe could only officially import the lowest quality, a stream of thin, more or less coloured, included and thinner diamonds: generally cleaved blades from partially transparent masses or crystal twins, which were harder to cut.

By calling them 'thick diamonds', the Bahian miners are therefore trying to advertise their finds of high quality diamonds that are highly sought after by European diamond cutters. In other words, advertising thick diamonds indirectly means that they are "of great value, like those once reserved for the Mogul emperors" (without prejudging their other qualities). All the garimpeiros knew this, raised their prices accordingly and, more importantly, let potential buyers know it.

Figure 30 . The natural pools of Serrânio (or Serrano) downstream of Poço Halley. Here, water from the Rio Lençóis flows from the heights of the Chapada Diamantina (in the background of the top image) to cross Lençóis (seen in the distance in the bottom image), the epicentre of a black diamond rush from 1844. These giant potholes, naturally eroded in a metaconglomerate (Mesoproterozoic), were mined for gem diamonds and carbonados since the mid-19th century. Photo: Gleidson Santos – MTUR Destinos (Creative Commons Public Domain Mark 1.0 licence).

Other rich deposits of gem-quality diamonds were subsequently discovered further north: Xique-xique (or Chique-Chique) do Igatù (since renamed Igatu), Andarahy (Andaraí) and a good thirty kilometres further north (as the crow flies) around a village founded around 1845 and dependent on Santa Isabel do Paraguaçu. This village, founded by merchants and

prospectors from northern Minas Gerais and the Recôncavo Baiano (Salvador), was elevated, in 1856, to the rank of *vila comercial e freguesia* (commercial town and parish) named *(Comercial) Vila dos Lençóes* (Figure 28).

Figure 31 . Location of the former *Companhia de Mineracão N°2* concession, covering around 4,400 hectares between the rios das Bicas and Roncador and including the mountains and the São José valley. The grey plots show the location of mines that are still visible, including Bicas and Brejo da Lama (Funch, 2005), where the Sergio carbonado was found. In fact, all these mountains were mined in the past (Funch, *personal communication*). Relatively recent diamond garimpos (Meira da Andrade, 1999) are indicated by the symbol ⚒. The red dot shows the photograph of the Roncador river in 2015 (Figure 32). Topographic map by OpenStreetMap France, under Creative Commons BY-SA 2.0 licence).

The city became a municipality in 1865 and was renamed Lençóes at the beginning of the 20th century (Martins, 2015). Vila dos Lençóes literally means 'city of sheets'. In Old French, lençóes translates as 'linçoels', which has the same etymology as linceuil (or shroud) in Old and Modern English, but at the time meant 'bed sheets'. According to some locals, however, the name may derive from the vision that travellers had when they discovered the village nestled in its basin, surrounded by thousands of white sheets that formed the garimpeiros camps that dotted the riverbanks. But for the writer Afrânio Peixoto, the name derives more from "the frothy whiteness of the river water that flows through the town" (Moraes, 1973).

Between the two towns of Mucugê and Lençóis, a large number of diamonds have been found in the watersheds and around the streams that flows into the Rio São José (Figure 30). In the midst of these gem diamonds, new compact black stones were also discovered: these were the first "black diamonds" to be found in Bahia. As they were not yet of interest to jewellers, they were discarded with the spoil.

A man called José Antônio Pereira, who arrived in the area in 1844, successfully prospected the bed of the São José, which was initially deep and rich in diamond-bearing sediments that were fairly easy to extract. Its bed and banks were rapidly excavated, and all the spoil eventually filled in a large part of its bed (Jacobs and Chatrian, 1884). In particular, he had an area excavated between the Rio Capivaras and the Córrente das Bicas, a stream which, according to Funch (2005), flows from its valley towards the São José at the hamlet of Piçaras (or Piçarras; Figure 31). This stream, which is rarely mapped, is currently called "riacho (or rio) Piçaras". These small individual prospectors or *faiscadores* (literally "spark seekers") probe each acre by means of small daily jobs, the "*faisqueiras*", a kind of light prospecting lasting a day or two with small equipment (sieve and shovel; Soares Miranda, 2015). Sometimes they find a *faisca* (spark), originally an unusual gold nugget, in allusion to its metallic lustre (the term "*faiscadore*" later became a local nickname given to occasional, even opportunistic, diamond prospectors in loose excavations, which are easier and quicker to work, or have already been prospected, such as fissures in harder rock, within the bedrivers alluviums or, just sitting on the surface). So, they

work their fingers to the bone to find the best areas. Later, areas that others have already explored, but too quickly or too roughly, are reworked by the best *faiscadores*, but with improved technique and expertise. They adapted quickly when, in 1849, a local economic crisis set in, linked to the excessive production of Bahian diamonds, which caused prices to plummet. The mines (known as *serviços* or *garimpos*) were then deserted, but they were resurrected the following year when the economic situation became more favourable (Castelnau, 1850).

6. The *Companhias de Mineração*

In 1856, the seeds of the rule of law were sown in an attempt to structure this small world by creating ten concessions to levy new taxes on the subsoil treasures owned by the Empire. Five concessions were granted in the Lençóis area, two in Andaraí, two in Igatu and one on the Rio Paraguaçu (Alma Toldeo, 2005). They are leased for fifteen years (sometimes ten) by as many *Companhias de Mineração*, consortia responsible for operating a concession. A *Companhia* is made up of a number of investors, with the Decree no. 465 of the 17th of August 1846 authorising only those with the best financial guarantees, including the great patrician families. Numerous lines of former patrician *Mineiras* conspirators, such as the household of *Comendador* Antônio Botelho de Andrade (-1863), who arrived in Lençóis in a sumptuous large crew, invested in more than four large-scale dwellings (Martins, 2013). All of this was intended to impress the local population that other mega-fortunate and already established patrician families such as the Caetité families with the Souza Spínola, da Silva Leão, Gomes de Azevedo and other patricians were also buying up the best land in Lençóis and the surrounding area. In turn, each family sent its offspring to sit on the *Repartição dos Terrenos Diamantinos*, the federal office that governed the concessions, including their auctioning via Byzantine rules that I am deliberately omitting here. As a result, the most profitable concessions quickly fall into the hands of the patricians, who are both judge and jury (Martins, 2013). They monopolised the *Companhias* at the expense of the independents who had scouted and cleared the good plots before them. This unequal competition generates conflicts between these prospectors and the large *Companhias*, which are systematically resolved by the police and the justice in favour of the latter. In other words, the first explorers-clearers (821 were counted in 1863) were "encouraged" to switch working for the ultra-rich patrician families (any similarity with a current situation would be purely coincidental...). In fact, they took advantage of the situation to explore, more or less clandestinely, the vast concessions allocated to them, which the immense fortunes of the few patricians did not allow them to oversee ("the law of the majority"). These *Companhias de Mineracão* were numbered as *N°1*, *N°2* and so

on. Six *Companhias* existed in 1862, spread over 6,534 hectares and employing 920 miners (at the same time, 113 plots were being worked by 1,130 self-employed miners, while thousands of faiscadores criss-crossed the mountains: Menezes, 1885). By 1871, there were 10 *Companhias* (Alma Toldeo, 2005). These consortiums were quick to share the profits: a large part of the gains fed the woes of the local political tradition, which had long since established a quasi-mafia system through clan rivalries and protection, leading to corruption, vote-buying, etc. (Saint-Hilaire, 1830).

Meanwhile, the twice-widowed Rita Angelica Souza Spínola (also named Spínola Silva or Spínola Soriano or Spínola Zama...) emigrated in 1849 to Mucugê and then Lençóis, despite the scandal related to her *caro dottore* Zama (or because of them). She moved with her brother Antônio (Figure 27 middle) and one of her sisters, not forgetting her eight children, seven of whom were born of her first and most honourable marriage (Spínola Silva or Spínola Soriano), along with her last offspring (Spínola Zama). All of this was done "with enthusiasm and fervour" (Aguiar, 2019) to add diamonds to their profitable activities: Rita Angelica and her Souza Spínola family soon joined forces with the de Andrades to take over *Companhia de Mineracão N°1*. This first concession, known as "das Bicas" or "Capivaras", covered an area of 9 million square fathoms (43.6 km^2). In addition to its actual size, this huge but rounded number says a lot about the logic behind the division of concessions. This *Companhia de Mineracão N°1* (Figure 31) was spread out between the Serra hills and the São José plain, where deforestation and extraction were gradually devastating the area, forming a huge aggregate of dusty excavations. In 1871, this concession was by far the most productive of all (Martins, 2013). That year, these placers produced more than *three contos de reis* worth of (declared...) gem and black diamonds, equivalent to around 3 kilograms of gold or 120 head of cattle in local terms. But the other co-owner of this concession, *Comendador* Antônio Botelho de Andrade, owns at least 2,355 in his fazendas (Martins, 2013). This imbalance is attributed to overproduction in the local mines and to the fall in prices with the start-up of the South African mines, at a time when meat is more commonly found on miners' menus than elsewhere. The Marquis of Pombal's old fear was confirmed: agriculture was competing with the mines,

which were irreversibly nibbling away at farmland. However, the local gallinaceous birds enjoyed it: Francis de Castelnau (1850) wrote this delightful anecdote from 1849 (translated): "... hens frequently swallow stones, so their intestines are never thrown away without first washing them. It has been observed that diamonds are mainly found in the gizzard".

Figure 32 . The *caldeirões* (giant potholes) of the Roncador, naturally dug into the sterile sandstone (one of the types of *pissara* or *piçara)* and emptied in the 19th century as well as the surrounding area where the topsoil was excavated to reach the underlying diamondiferous sediments (they have since disappeared). Photograph © Carlacon75 (Creative Commons Attribution-Share Alike 4.0 International licence, slightly desaturated).

The *Companhia de Mineracão N°2*, known as Roncador, is located just to the south of the first. It stretches for 4.5 kilometres along the banks of the São José between the Bicas valley to the north and the Roncador river to the south. This river also meanders eastwards for around fifteen kilometres along ledges dominated in the south-west by the Morro do Manuel Vitor (1,585 m) to the marshes (*marimbus*) of Remanso, known locally as the "Pantanal", at an altitude of around 300 metres. It is coordinating its operations around areas that have already been meticulously devastated, such as the *Brejo da Lama* (literally "mud swamp") located in the mountains between the Bicas and Roncador valleys (Figure 30), which Roy Funch (2005) was able to heritage before it was too late (i.e., during the lifetime of the last garimperios, whose traditions remained

oral). This vast concession was taken over by the Gomes de Azevedo family (Castelnau, 1850), who established their fazenda do Roncador to the south of the site, of which nothing remains today other than what local memory refers to as *Antigo Casarão de Roncador* (the old villa of Roncador), now a restaurant located near the giant potholes of the Rio Roncador (Figure 32).

One of Rita Angelica's daughters (*Companhia N°1*), Virginia Josephina (1830-?), became involved with José Venâncio Gomes de Azevedo (circa 1820-1874), who operated *Companhia N°2* (*what else*?). This José Venâncio is shown in the genealogies as having been born in 1788, nine years before his own father (1797)... I have therefore estimated a slightly more reasonable birth date of around 1820. Following Lusitanian patronymic rules, the bride's name changes from Spínola Soriano to Soriano de Azevedo (she is even sometimes mentioned as Gomes de Azevedo in certain documents). Among many other children, they had César Venâncio (dates unknown), who ran his parents' concession at Roncador, which fed into Domingos (III), who had to make the family mining fortune bear fruit in his own way. Paul Serre (1913), then French consul in Brazil and MNHN correspondent, tells us of a journey in March 1856 "from Roncador to London" by a certain "Domingos Gomez", who must have been Domingos Gomes de Azevedo (III). Aged 18, he took with him some 6,475 carats of carbonado, which he was delighted to sell for 5 shillings a carat (a quarter of a pound; around €20 today). The London diamond merchants were even more delighted, as the price of black diamonds was already beginning to rise sharply due to the ease with which he polished gem diamonds (Furniss, 1906). Following this substantial fortune for the region of Brazil at the time, he became the "doctor of the Roncador" and, with his sons Clemente and Teotônio, developed lapidage workshops in conjunction with their cousin Teófilo Vulther (or Walter depending on the source, 1834-1909), son of Domingos II. Because faceted products are even more profitable than rough ones, especially when labour is almost free, plentiful and slavish, as it was in those days.

As far as European investors were concerned, the situation was mixed. Jacobs and Chatrian (1884, p. 154) state that "many operators, among whom I count several friends, not a single one of them has become rich, while several

have ruined themselves. Speculators are undoubtedly happier. But we still don't know all the difficulties they have to contend with. The journeys they have to undertake are not only excessively expensive, but also extremely arduous". On the subject of the slaves, the two Antwerp experts add: "who make the journey to the mines of Bahia on behalf of the traders, do not resist such fatigue for long. They are soon swept away by the terrible malarial fevers, endemic to these countries, which they contract on the roads." Thus, because of the semi-stagnant water found everywhere, anopheles mosquitoes spread malaria in its worst forms (Furniss, 1906), while smallpox and the local *carrapatas* (a type of blood-sucking tick; de Castelnau, 1850) were not to be outdone.

Despite the disappointments of some, others helped the Chapada Diamantina to prosper. For example, it has been forgotten that Lençóis was, at the height of its brief boom – in the 1850's – no less than the world's largest producer of diamonds, both natural and cut (Mangili, 2023), surpassing India and Minas Gerais not only in total carat weights but also in gem quality. Jacobs and Chatrian (1884, p. 49) explain that it is the Lençóis and Veneno (Roncador) regions that produce the whitest (i.e., colourless) diamonds admired the world over. Only the larger stones, weighing more than 50 carats, are absent from Bahia's production. This "golden age" came to an end when the South African deposits were annexed and exploited on a much larger scale by the British.

Masters, Slaves and *Garimpeiros*

1. Servitudes

These diamonds can no longer be dissociated from the appalling human context of this remote mountain region of Brazil at the time. The law of *braço, punhal e fuzil* (arm, dagger and gun; Martins, 2013) reigned. Among the large landowners, many local politicians sought immediate profit without investing in high-performance equipment, relying instead on "competitive" labour, namely slavery. From 1849-1850, the houses of Andrade and Gomes de Azevedo brought to Lençóis "*consideravel fortuna, inclusive grande escravatura*", considerable wealth, including a large number of slaves representing, respectively, a hundred and a hundred and twenty slaves (Castelnau, 1850; Martins, 2013). These unfortunate people numbered in the hundreds, soon after in the thousands. They were enslaved by two political clans who formed the "diamond aristocracy" (Banaggia, 2019), but who fiercely disputed power. These conflicts were the domain of colonels, lieutenants and other commanders, who were generally shareholders in the *Companhias de Mineracão* (Martins, 2013). The ultra-conservatives known as "slavocrats" are nicknamed "*mandiocas*" because they (particularly their slaves) traditionally devoted themselves to growing cassava (*mandioca* in Portuguese) around the capital Salvador and, more specifically, in the Recôncavo, a geographical region stretching around the Bay of All Saints. They are also known as the "Bahianese" (Martins, 2013), i.e., people from the coastal plantations (*Planalto Atlântico* region) who retain their supporters in the capital Salvador but also in Lençóis, such as the powerful Coronel (Colonel) Antônio Gomes Calmon (?-?; Silva, 1992), the great leader of the *mandiocas* (who is also a shareholder in *Companhia de Mineracão N°2*. Most of them are newcomers from the Atlantic coast who have since settled in the mountains of the hinterland. On the opposite societal side, the "liberals" are known as *pinguelas* or *mosquitos.* They migrated to the central plateaus of Brazil (the *Planalto Central* region) like the houses of de Sá, Gomes de Azevedo and Bothelo de Andrade families, among

others, whose grandparents had once fled their native Minas Gerais for Caetité following the *Inconfidência Mineira*. Hence their other name, "*serranos*" ("mountain people", Banaggia, 2019). At the time, they were led by Felisberto (or Felizberto) Augusto de Sá (1832-1897), a man of "recognised human qualities" (for the time...) and a shareholder in *Companhia de Mineracão N°1*.

Figure 33 . Coronel Felisberto (or Felizberto) Augusto de Sá, born in Minas Gerais and leader of the "pinguelas" in Lençóis. He is the son-in-law of Comendador Antônio Botelho de Andrade. Source and credit: Pesquisalen/Wikimedia Commons.

Supported by Emperors D. Pedro I and II, these fazendeiros/politicians claimed to be abolitionist on paper, but nevertheless owned a large number of slaves as well as employing labourers. Each group has its own colours for their own celebrations. These struggles often boil down to personal quarrels between *coronéis* (colonels), as each group does not really have a clear political agenda (Silva, 1993). The former criticised the latter for being too tolerant, which encouraged slave rebellions. Conversely, the *pinguelas* accused the *mandiocas* of arrogance and barbarism. For example, in August 1869, Colonel Espinola (1869) reported to the former abolitionist governor of Bahia (1865-1866), Judge Manuel Pinto de Sousa Dantas (1831-1894), the misdeeds committed by a *mandioca* militia against the local population, affecting fazendeiros (implied by the *pinguelas*), merchants and poor miners, most of whom were described as "*verdadeiros leões para o trabalho*" (real lions at work). According to his report, these militiamen use certain city markets as an opportunity to arrest people, who

they then ransom for their release (if they don't die in a dungeon in the meantime). The colonel complained that the region had been left in the hands of *insensatos, doudos* or *bêbados* (fools, imbeciles or drunkards) rulers: he targets the judge-deputies Antônio Ladislau de Figueiredo Rocha, Francisco Gonçalves Martins, Baron of São Lourenço, and Antero Cícero de Assis, who seized presidential power in Salvador in 1869 and purged the *Pinguelas* government after the term of Manuel Pinto de Sousa Dantas. According to Espinola, these militias robbed and set fire to reign terror: many businesses closed as a result of the repeated looting by the squadrons, causing prices to rise and famine to threaten. The most terrible of these raids targeted the First and Second Companies, which were too "*pinguela*": César Venâncio Gomes de Azevedo was even arrested. His miners' dwellings were set on fire and various fazendeiros' houses were destroyed, including his own, except for that of "*um francês que arvorar a bandeira da a lá nação*" (an unnamed Frenchman flying the flag of his nation; Espinola, 1869).

On the subject of everyday violence, as mentioned above, Jacobs and Chatrian (1884, p. 184) add (translated): "These lines perhaps bring to mind possible crimes in these lost countries, where a lone man, barely armed with a dagger, carries a fortune with him. Nothing like this has ever happened. And, to the credit of this hospitable country, no trader thinks of guarding against thieves, so unknown are they here." However, this view was not shared by some locals, and once again Antwerp merchants Jacobs and Chatrian were suspected of trying to attract sympathy and therefore investors to their trade. For example, Guanaes (2001, p. 61) heard testimony from a miner whose grandfather, also a garimpeiro, was a victim of "*pequenos golpes*" (small scams, [sic!]). The grandfather in question (translated): "arrived in the company of a 'gringo' from Belgium, who said he was interested in buying 16 diamonds of fine water, without any impurities, each weighing between 10 and 12 carats. The garimpeiro gave the mine owner the bag containing the stones, took the gringo to town to do some business and said he needed to examine the diamonds more closely. The owner returned a few hours later, his clothes torn and without a harness (on foot), claiming that he had been mugged on the way and that the gringo had been seriously injured on the road. The stones? They

were never seen again, and neither was the gringo buyer. The garimpeiro thought that the owner had tricked him into stealing the stones without giving him his money in return."

However, since the abandonment of intensive diamond mining, things have changed and the Chapada Diamantina has become the place publicised by Jacobs and Chatrian, i.e., a serene place relatively untouched by the insecurity that reigns in larger conurbations (Roy R. Funch, *personal communication*).

2. Garimpeiross and slaves

In this pre-abolition era (before the *Lei Áurea* of 1888), miners were mainly men: independent or salaried *garimpeiros* (monthly paid labourers or day labourers). Some, known as *piões,* sought the trust of the large landowners to take up supervisory or even management positions. Work on the garimpos is generally irregular: according to Guanaes (2001), there are days of relative idleness when the work is (relatively...) limited to removing soil from a virgin area and placing it on an area that has already been explored; the rest of the day is devoted to conversation and gossip, the price of diamonds and stories or accidents that have happened in other mines. This author also explains that, until recently, the garimpeiros lived between the town and the serra: in town, they "packed a bag" (*fazer o saco,* a bag of provisions) to go and mine for diamonds in the mountains. If they found diamonds, they would fill their bags with the stones and return to the city (and so on). We also learn that the miners lived sparsely in the mountains, where they would stay for around two or three months when mining was booming, and then return to the town (or to a fazenda below) to be near their families when the "bag was full" again (hopefully, with diamonds).

In the richest and most densely worked mining areas within the countryside (valleys or mountains), there were small improvised stalls stocked with foodstuffs and basic products to "survive". There were also small bars and fazendas where the miners and their families could stay. Some houses had backyards with abundant vegetable gardens and orchards producing a small subsistence plantation of cassava, maize, beans, mangoes and even coffee, which became famous throughout Brazil. Some areas whose subsoil had been mined were so densely populated that they formed small villages or even rural districts, such as the *Alto das Estrelas* (High of the Stars) district to the south of Lençóis, which inherited the same name as the mining operation that once stood there. With the growing sense of ownership and covetousness, there were many disputes over invasions into mining areas that were resolved in the city court, but the vast majority were resolved in a personal and direct manner, based on bargaining and even physical violence (Guanaes, 2001).

Figure 34 . The main square (*praça*) of Lençóis (then written Lençóes) on a fair day (late 19th century - early 20th century), currently known as Horácio de Matos. Note the large proportion of men compared with women and children. Photo: © Roy F. Funch (from a photograph in the former collection of the late garimpeiro Mestre Oswaldo, with permission).

In the 19th century, some miners were freed from their former masters thanks to the discovery of a large diamond (this will be detailed below): they worked alongside a majority of slaves in the same mine. Captive women were in the minority, even in town (Figure 34).

In addition to the Amerindians, the slaves were essentially of wholly or partially African descent (Furniss, 1906). A plethora of nomenclature specified the racial position of each among the *africano*, *caboclo*, *cabra*, *crioullo*, *jeje*, *mulatto*, *nagô* (etc.), which was itself lost in its own conjectures, both stigmatising and variable in time and place. One finds it in the notarial deeds concerning them, just after the names of the people and even before their age. Martins (2013) observed that two-thirds of the slave owners surveyed in 1871 in the Lençóis region declared that they owned slaves, an average of nine. This author also reports that in 1871, the post-death inventory of the late Antônio Gomes de Azevedo (probably an uncle or cousin of José Venâncio) was compiled. He had

"squandered" (other says: donated) his fortune on loans and gifts, as he was much appreciated for his kindness and generosity (Santos, 1997). Still, he had 40 slaves, 32 of whom worked in the mines (30 men and 2 women), 8 in the fazendas (2 men and 6 women); 31 were of mixed race (mulattoes and capers), 31 were Brazilians (by birth) and 9 were Africans (deported young via Salvador de Bahia).

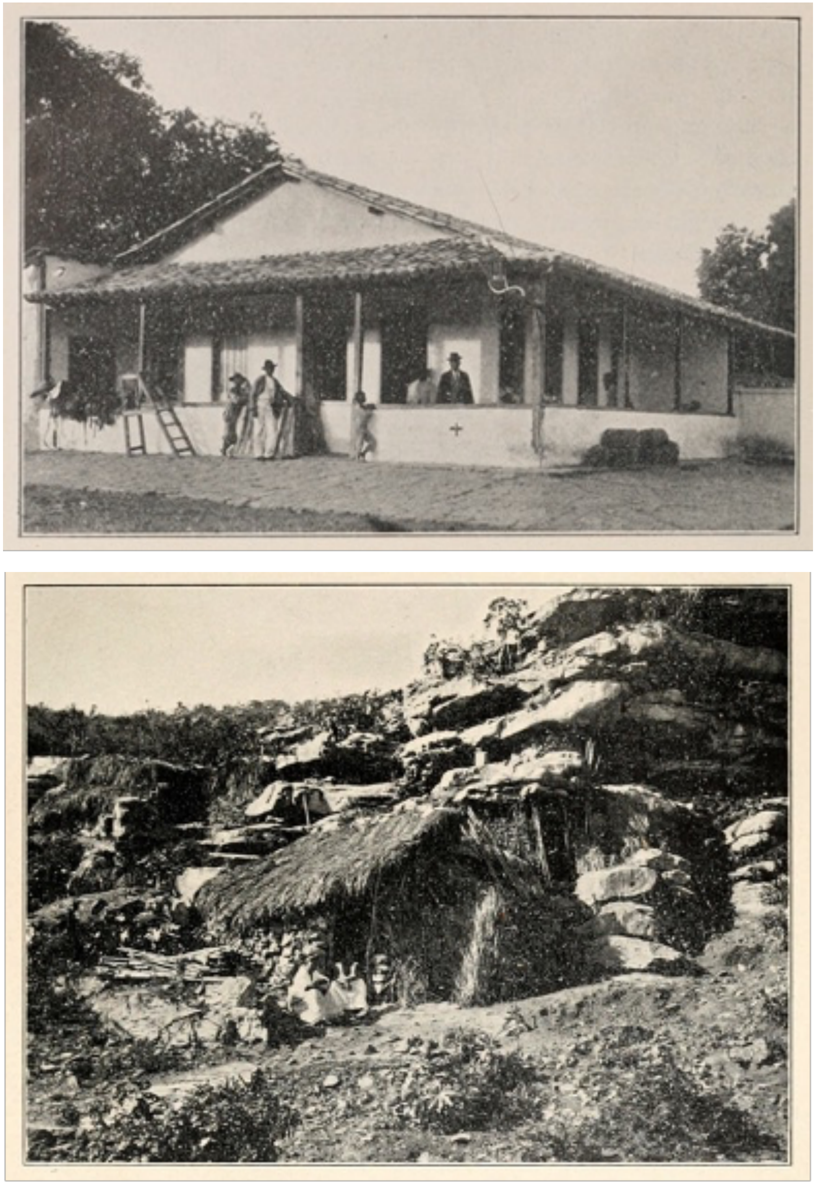

Figure 35 . Property of a rich mining owner and miners' huts in rock shelters (*toca*) covered with pindoba straw, a word of Amerindian origin (Tupinambá culture) for the local *Butia capitata* palm tree. Although these photographs date from the early 20th century, when slavery was abolished some twenty years earlier, the inequalities are still glaring. Source: Furniss (1906, p. 277) / archive.org.

The coexistence of the words “kindness” and “generosity” in the context of this trivialised coercion seems to exonerate these masters from the inhuman conditions they maintain in order to consolidate their wealth through a social constancy that seems to them to be endowed with generosity. For instance, a slave who found a diamond worth more than one *oitava* (i.e., 17 *karats* and 2 grains, or 17.93 carats today) and returned it to his master was solemnly emancipated, while the State – which compensated his master – sought above all to limit smuggling (Nouveau dictionnaire d'histoire naturelle..., 1817, IX, p. 392). Conversely, the “reason of the wombs” prevailed: if the mother was a captive, so were her children (this despicable law was abolished in 1871). Slaves were sold, exchanged, given away, inherited or even mortgaged before a notary and witnesses as if they were expensive material goods. Often wearing gaiters, especially miners and farmers, they could be better dressed, especially domestic servants. And some had to endure the whims of their masters on a daily basis (you can imagine the daily abuse of women, but not only women...). In all cases, they walked barefoot.

Figure 36 . Toca (built rock shelter) emblematic of the Chapada Diamantina near Igatu. Photo: © Fred Schinke (2010, www.flickr.com/photos/fredfoto/4875721516), CC BY-ND 2.0 (creativecommons.org/licenses/by-nd/2.0).

Their owners lived relatively comfortably in colonial-style stone houses, while the miners slept in dormitories on the fazenda or in shacks in the mountains (Figure 35). These were often converted rock shelters known as "*tocas*"; Figure 36). These crude rock dwellings – so emblematic of the garimpeiros of the Chapada Diamantina – are bounded at the front by drystone walls with entrances, more rarely with windows. For ease of access, they are located in the vicinity of the mines, which are often several kilometres away from the urban centres where the diamonds were sold, as in Lençóis. They are now in ruins, scattered here and there in hundreds in the mountains (Funch, 2005, 2022). They are still used by the last independent garimpeiros and are now an occasional refuge for hikers.

3. Diamonds and franking

Although the Congress of Vienna decreed the slave trade internationally illegal in 1815 – as a result of British (pseudo-)humanist efforts aimed above all at developing their international trade to the detriment of France, Spain and Portugal, which were entrenched in their slave economies – it continued clandestinely towards the empire of Brazil until the 1850s. One example is the terribly poignant case of the slave Madi Magassa, who in July 1853 found his way to Bagagem (in Minas Gerais, a town renamed Estrela do Sul in 1901; Figure 6), a magnificent gem diamond weighing 52.276 g, the future "Étoile du Sud" (*Estrela do Sul* or *Star of the South* ; Figure 37), which she returned to its owner, Casimiro José de Moraes, who in return freed her and offered her an annuity for life. He was tricked into selling the diamond for only a tenth of its price to buyers in Rio de Janeiro, who then sold it to the Parisian financier and diamond dealer Joseph (Frédéric) Halphen (1822-1896) for ten times as much. He then gaves this diamond its original name, "Étoile du Sud" (while "Star of the South" is an unwanted and late alteration imposed by English-speaking experts).

Was Madi's emancipation – by an obviously uninformed, naive or gullible Moraes – the result of an "empathetic tradition" or a sordid calculation? Current chroniclers of celebrity diamonds (e.g., Smith and Bosshart, 2002) also fail to mention reports in French explaining that Madi was an old woman at the time (Babinet, 1868). And that a decree of 1732, still in force, would have forced her to emigrate outside the diamond-producing regions if she had been emancipated (Robinson, 2021). So Madi was forced to refuse her emancipation... To understand the cultural gap between the French and Brazilians of the time, the following account, which has unfortunately been largely forgotten, highlights the lack of understanding on both sides. When French physicist Babinet (1868) asked one of his Brazilian friends why Madi refused so unpredictably, the latter replied, 'What would she have done with it?'

Figure 37 . A glass model of the Étoile du Sud weighing 261.38 carats (and not 254.5 or 261.24 carats as is generally stated). Dufrénoy (1856) was one of the few to be able to study it before it was recut: it is a rhombododecahedron with obtuse angles (tetrahexahedron) composed of 24 facets that crystallised adjacent to an octahedron, the imprint of which remains. Gift of Joseph Halphen, 1855, 47 x 34 x 29 mm. Paris, MNHN, mineralogy, inv. 55.104. Photo: © François Farges/MNHN.

Indeed, as well as emigrating to make a new life for herself in the twilight of her life, Madi would probably have had to leave her loved ones, perhaps even her family, still enslaved to this yoke. Martins (2013) describes various dramatic examples of emancipated people seeking to buy back the freedom of their relatives who remained in slavery, such as the freedman Domingos Gomes de Azevedo, known as "africano" because he was born of African parents and enslaved to the Gomes de Azevedo family. In 1870, he managed to buy back the freedom of his daughter Bernardina, aged 9, for the sum of one *contos de reis* (I dare not transpose this into today's value; such a calculation would be sordid but it is obviously a very large sum). Another, João Cabra, obtained his emancipation in exchange for 40 head of cattle, and then freed his two brothers with the same amount for each. Between 1848 and 1870, Martins (2013) lists no more than 170 emancipations from a population of several thousand slaves.

Killing one's slave was punishable by criminal proceedings, but these

never came to anything. The opposite case could be fatal if the death sentence was not commuted to galleys by the emperor. As in the case of the slave Antônio, who, after killing the infernal *dottore* Aristide Zama, was tortured and then hanged, sparking a revolt that heralded the forthcoming abolition (Santos, 1997).

Some slaves fled from agricultural fazendas (growing sugar cane or coffee) to seek a new life in these remote diamond mountains, where justice was an option and meat was a little more often available to miners (instead of the endless cassava beans). Wealth and freedom seemed within their grasp. Except when they spoke out too much or when so-called friends trapped them in captivity (read the appallingly sordid case of André and Nicollau: Martins, 2013). Rather than take refuge there, others escaped this instituted oppression and hid, for example, in the Remanso swamps where the water protected them from the slave hunters' colossal dogs. There they formed brown communities, known as *quilombos*, which are an important part of present-day Brazilian society, particularly in Bahia, including the *Quilombo do Remanso* and the *Fazenda Velha* between Lençóis and Andaraí.

Martins (2013) analyses the existential perseverance of this enslaved humanity, motivated nonetheless by the hope of a liberating diamond find that would allow the oppressed to dream of better days, with a chance of emancipation tinged with surplus wealth. Slaves enslaved on agricultural estates or in domestic service rarely had this "opportunity": some managed to acquire a form of self-education, knowledge and a liveliness that only a tiny minority were able to use to help free themselves. When you read all these notarised deeds, some of them written just 150 years ago, you are struck – because any impartial historian cannot register his deep disgust here – by the trivialised "normality" of slavery. Moreover, how could this Aristide (César) Zama, a proclaimed advocate of "the freedom of peoples", a disciple of Garibaldi who took refuge in South America to escape the despotic tyranny of Italy, naturally take possession of his wife's slaves, a system that had disappeared from his native Italy centuries earlier, only to tyrannise them so odiously in Brazil? None of the parishioners, familiar with the biblical accounts of the enslavement of the Hebrews in pharaonic Egypt (a story of enslavement

considered to be true at the time), had anything to say about it: the "new possessions" of these so deeply devotees – I mean the new-borns victims of the law of the womb – were even piously baptised in church.

Figure 38 . Left: Auguste Petit (1844-1927): Princess Isabel (1869); right: Manuel Poluceno Pereira da Silva (active 1850-1890): Emperor D. Pedro II of Brazil (1859). Like his Portuguese and Brazilian predecessors, the sovereign wears a Golden Fleece insignia in a very Lisbon style. Rio de Janeiro, Museu Histórico Nacional, inv. 3673 and 6458. Credits: © Museu Histórico Nacional, Wikimedia Commons (CC-PD-Mark, public domain).

4. Emancipations

In 1888, the Lei Áurea proclaimed the abolition of slavery in Brazil. It was signed by Dona Isabel (1846-1921; Figure 38, left), Imperial Princess of Brazil and heir presumptive to the throne, in her third and final regency while Emperor Dom Pedro II (Figure 38, right) was abroad. This was followed by a series of laws aimed at eradicating this condition, including the *Lei Rio Branco* (or *Lei do Ventre Livre*), which repealed the former "reason of the womb" in 1871 (tough teenagers were still kind of enslaved until the age of 21).

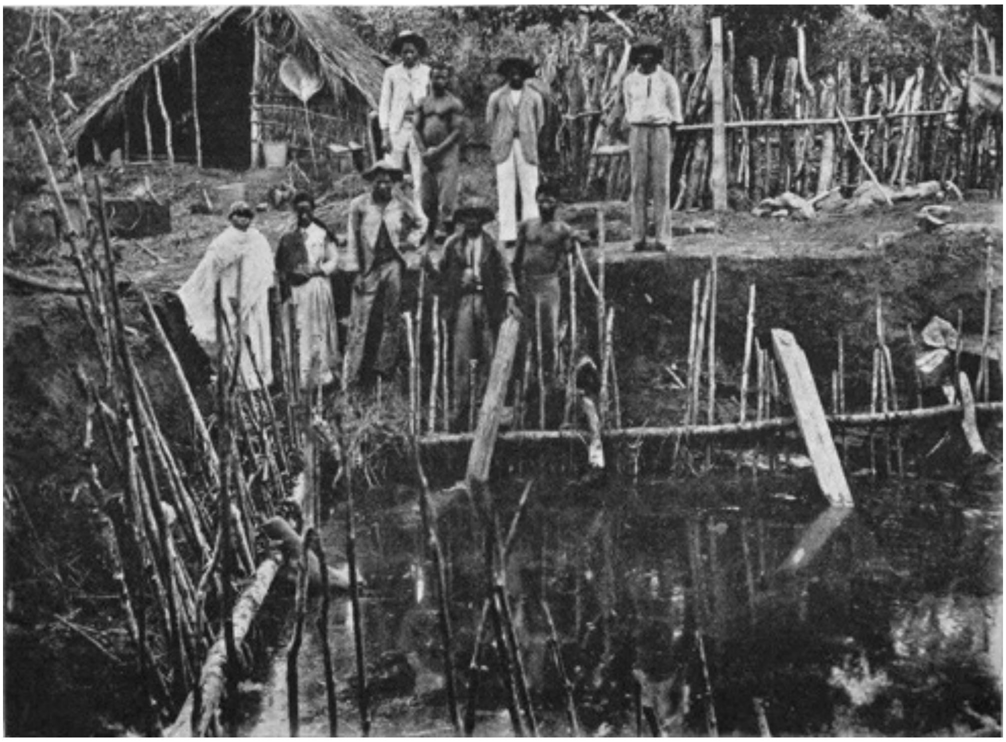

Figure 39 . Photograph by Harry Johnston (1910) showing an exploited *cascalhão* near Lençóis. Living conditions were terribly difficult, especially for the only two women on the left – note their dignity in this male-dominated world – despite thirty years of official emancipation from slavery. A makeshift hut has been built next to a flooded (in the rainy season) mining trench (*cascalhão*), which one imagines is infested with insects thriving in this virulent malaria breeding ground. Credit: New York, The New York Public Library, Schomburg Center For Research In Black Culture, Jean Blackwell Hutson Research And Reference Division, "The Negro In The New World" collection, inv. 1227081.

However, the monarch – who was frail and elderly – was soon deposed in a coup d'état instigated by the ultra-conservative clan that proclaim the (first) Republic of the United States of Brazil. Hopefully, these wealthy Republicans, which fortunes was based originally on slavery, would not turn back the clock,

as Napoleon I had done with the disastrous decree of the 20th of May 1802 re-establishing slavery in France (originally abolished in 1794 under the French Revolution). Obviously, the harsh lesson that the state of Haiti imposed in 1804 for its independence to French Emperor Napoleon had been understood by Brazilian politicians. The latter, who were also under British influence, established this First Brazilian Republic in the form of an economic dictatorship (oligarchy) in which private interests took precedence over those of the nation. However, many former captives, such as Madi, are forced to continue working for free for their former masters, in the absence of social support and prospects. The former masters shamelessly justified this “by the absence of financial compensation” from the promulgating federal state (Saillant and Araujo, 2007), even though there was, in truth, some financial “compensation”.

Be that as it may, the conditions of the former enslaved people were generally miserable, socially, materially and psychologically: having just passed from slavery to a form of serfdom, they lived outside the time of dignity (claimed to be “Christian”, among other humiliations from their former masters). Material conditions remained difficult and uncertain (Figure 39). On the subject of this social transition, Banaggia (2019) points out (translation by the author): “There was a difference between those known as "mineradores" (Author's note: the professional shareholders organising the available technologies with a view to profitable exploitation), linked to the Empire and carrying out the activity with imperial authorisation in the mountains leased to the entrepreneurs by the Crown, and the garimpeiros (actual miners who exploited in a more heuristic way, either independant or at the orders of the former) ; among whom former slaves could be counted who often worked clandestinely. The gradual transition of the entire contingent of the population to free but unsalaried work marked the erasure of this distinction, uniting all workers under the same moniker of "miners" – one of the reasons why the question of the slavery of a considerable number of their ancestors is treated by the present-day inhabitants of Lençóis with a certain fear and without much depth.” (Author's note: this last expert's observation seems somewhere fairly harsh to me).

Figure 40 . A mountain mine (*serviço do morro* de type *gruparia*) in its early stages of exploitation, when the garimpeiros remove the topsoil (first shot) and then the seepage water (second shot) to gain access to the diamond-bearing gravel at depth. Source: Furniss (1906, figure 4, p. 278) from archive.org.

However, the situation at the time was not totally "appalling" for some: Claude-Henri Gorceix (1842-1919), the French geologist established in Brazil by demand of Pedro II, asserted (Gorceix, 1882) asserted that although (translated) "slaves did indeed steal half of the discoveries, this petty theft has dropped considerably since abolition" (we leave the reader to ponder this...). For another and more local example, Ganem (2001) states that at *Companhia*

N°1, José Antônio Pereira treats his former slaves "correctly", who have become labourers or day labourers whom he even calls "*camaradas*"! The observations of Gorceix and Ganem show that this legislative emancipation, which nevertheless excludes wage-labour, remains tinged with a more subtly psychological paternalistic, formerly colonial, enslavement (without necessarily invoking Karl Marx, read the debate by Jacquot *et al.*, 2018 on the complex relationship between work and emancipation which give more keys to this issue).

The incredible qualities of the garimpeiros are also praised in an article by a certain Desouza Dantas (1919, probably related to the Manuel Pinto de Souza Dantas mentioned above; next in translated from the Portuguese): "The known processes for extracting diamond and carbonate are still the most rudimentary. However, the dream of fortune turns prospectors into giants. The jargon they use among themselves when proclaiming is enough to prove our point: The prospector does things that God doubts."

Figure 41 . Photograph of the Estrela do Céu mine (Star of Heaven, not "Estrella do Céo") located a few kilometres west of Lençóis (written Lençóes" at this time). Date unknown, possibly early 20th century. Photo: © Roy R. Funch (from a postcard from the former collection of the late garimpeiro Mestre Oswaldo, with permission).

On Mother nature's side, the extensive raking of the mountains and valleys continued: the topsoil was removed to reach the deep diamond-bearing layer, which devastated the forests (Figure 40). According to Ganem (2001), a large black diamond weighing 33 oitavas (592 carats) was found in 1904 at Estrela do Céu, a serviço located a good two kilometres west of Lençóis, while following the course of the eponymous river and a small tributary flowing down a steep valley. This garimpo was then owned by Antônio Leal, from a family of *serranos* originally from Caetité and related by marriage to the Spínolas. The 1904 find may well have been immortalised in a postcard, which above all reflects the social relations of the time (Figure 41).

Antônio Leal (or one of his siblings) is perhaps the dominant figure in this commercial photographic pose, which above all betrays the sociology of the time. The rise of photography, and even this form of marketing, is clear here: the photographer has imposed a staging in which everyone exposes themselves according to their social status. The *fazendeiro* places his foot on a stone that has no natural reason to be there other than to show his superiority over all else. This stone is set on a large rounded rock, almost in the shape of a ship, where the owner seems to be holding the prow. He is posing theatrically, almost in *contraposto*, in a sort of shimmy emblematic of ancient Greek statuary (chiasmus). Below him, at his command, is a possible steward or engineer, falsely relaxed, trying to show off his technical mastery and confidence by holding his umbrella like a sceptre, or even a matamore's boner, pointed at the three labourers. The young overseer is frozen in place, with the excavation tools to his right, prominently displayed and positioned as if to indicate order, discipline and the full mastering of productivity through their "technology". These three characters give the impression of superficial antics, ready to please the camera, the commercial promise to the investors targeted by this postcard.

Far below, the two miners were clearly chosen to symbolise the excellent, almost virile physical health of the *Companhia*'s staff, as well as a clearly assumed racial parity: the old misdeeds of slavery seem irreversibly dissolved in a new economic concord that is orchestrated here as supposedly beneficial to all castes. For the pose, each of the two miners is neatly dressed in white, immaculate, with no visible rags and identical, symbolising the equality of a

status that has become honourable. But the reality was quite different: the old traditions quickly reappear in details that speak for themselves. For instance, the two garimpeiros pose partly submerged in running water, as if to remind them of their inextinguishable lowly social position. They humbly present their pan to the camera so that their abundant contents of diamond-bearing gravel – considered here as the most important subject – can be seen, while posing as sturdy, almost inanimate rocky columns. However, out of this composition that seeks to sell promises according to the codes of the time, the two garimpeiros' gazes, forged by an authentic existential hardness, nourish remarkably magnetic faces that would have their place (in my opinion) on today's catwalks, be they fashion icons or sports heroes. This form of cold, distant beauty is also reflected in the poetically evocative name that the miners gave the mine, "Star of Heaven" in English. The name is not only poetic but also full of symbolism, again understandable within the local codes. Garimpeiros used to say (Banaggia, 2019) that for every star in the sky, there is a diamond in the Earth, and vice versa. This is the principle of the *Encanto do Diamante* – the enchantment of diamonds – so emblematic of the culture of the Chapada Diamantina miners, where stars, humanities and diamonds form an almost theological triangle (Senna, 1998) so rich that it requires explanation: this is the jarê, as introduced now.

5. *Na fé em diamantes*

It would be far preferable and legitimate for a specialist in the humanities of the Chapada Diamantina to discuss this aspect here. However, I have attempted to summarise the numerous essays, mainly Brazilian, that have been written on the subject and to highlight the recurring ideas. The main idea, which is as beautiful poetically as it is supernaturally splendid is that diamonds invite garimpeiros, whatever their status – social rank and skin colour – *na fé em diamantes*, to "that faith in diamonds" (Martins, 2013). Hope is idealised through the hope of a *bambúrrio* (originally, a lucky gambling win) in the form of a large, shiny stone or a rich "vein" (in fact, a karstic fissure, as will be explained in the penultimate chapter of this book) that will bring happiness, fortune and freedom, in other words, the social position of a lucky individual who has become wealthy and a celebrated personality. It is in the spirit of the *Glückauf* – good luck – of the Germanic miners, from Saxony to Alsace, which also implies "come back safe and sound" because of the dangers of any mine, whatever its latitude. According to Furniss (1906), this sort of local mysticism overlaps with devotion to *Santa Bárbara* (Saint Barbara), the patron saint of all miners: she is said to have appeared under a sacred tree where the garimpeiros continue to place a stone the size of the coveted diamond on one of its branches. Although Nossa Senhora da Conceição (Our Lady of Conception) is officially the patron saint of Lençóis, her low popularity among the locals has become notorious, as has *Santa Bárbara*. Nowadays, most of the population is devoted to Nosso Senhor Bom Jesus dos Passos (Our Good Lord Jesus of the Stations of the Cross), patron saint of the garimpeiros, alongside the entities and saints of the jarê (we will come back to this shortly) and through local folklore events such as the *Marujada* and the *Ternos de Reis* (Costumes of Kings). The latter is a series of costumed ceremonies – parades and concerts – originating in Portugal and imported in the 18th century, which celebrates the Three Wise Men (Guanaes, 2001) in a Brazilian version that promotes simplicity and praiseworthy intentions, but also the prosperity brought by a good harvest which, as well as being agricultural and food-producing, also includes diamonds in Lençóis.

Le Senhor dos Passos

Devotion continues today to Senhor dos Passos — the Lord of the Way of the Cross — the Catholic patron saint of the garimpeiros of Lençóis (Banaggia, 2019). To commemorate him, the eponymous church has stood atop 21 large steps (Figure 33) on the north bank of the Lençóis River since 1855, and the *Canção do Garimpeiro* (miners' song) is sung:

Avante garimpeiros, bem unidos	*Forward miners, united*
Sêde do País, lição, preceito, exemplo,	*Be of the country, lesson, precept, example,*
Cantando ficarão vossos gemidos	*Your groans will be sung*
Nesse altar de granito, vosso templo.	*On this granite altar, your temple.*

In 1954, an anthem was composed by Celso Ferreira Cunha (1917-1989) — the great Brazilian writer — and Father Martins (for the music) in his honour, which is perpetuated by the *Sociedade União dos Mineiros (SUM)* of Lençóis notably during the *Festa do Senhor dos Passos* (a festival currently being classified as intangible and tangible heritage of Brazil, IPAC and IPHAN) between 23 January and 3 February.

(Côro) Senhor Bom Jesus dos Passos	(Chorus) *Our Lord Jesus of the Steps*
Galgue montanhas, espaços…	*Climb mountains and spaces*
O louvor de todos nós;	*The praise of us all;*
São diamantes lapidados	*They are cut diamonds*
Os corações devotados	*From the devoted hearts*
Dos mineiros de Lençóis	*Of the miners of Lençóis*
(Solo) Ofertemos, mineiros das Lavras	(Solo) *Let us offer, miners of Lavras*
Diamantinas, ao bom Redentor,	*Diamantinas, to the Good Redeemer*
Os cristais mais brilhantes, seletos	*The most brilliant, select crystals*
De nossa alma – garimpo de amor…	*From our soul - miner of love...*

I

Esta Cruz que vos pesa nos ombros	*This Cross that weighs you down*
Suportá-la quiséramos nós;	*We wanted to endure it;*
Indulgência às rebeldes ofensas	*Indulgence for rebellious offences*
Que nos deixam distantes de Vós.	*That leave us distant from you*

II

Garimpeiros, humildes, juremos	*Garimpeiros, humble ones, let us swear*
Com firmeza, perante este altar;	*Firmly, before this altar;*
Querer bem a Jesus e patrono,	*To love Jesus and the saint patron,*
Sua lei com fervor praticar.	*Practise your law with fervour.*

III

Bom Jesus vossos passos sagrados	*Good Jesus your sacred footsteps*
Estão vivos impressos no chão,	*Are imprinted on the ground,*
Permiti, nos aponte o caminho	*Allow me to show us the way*
Onde há paz infinita e perdão.	*Where there is infinite peace and forgiveness*

Figure 42 . The church of Senhor dos Passos (Lord of the Stations of the Cross) is located on the north bank of the Rio Lençóis, in the town of the same name. Credit: © Jcornelius, Wikimedia Commons (Creative Commons Attribution-Share Alike 4.0 International licence, slightly cropped).

So, what may appear to be a simple "game of chance" is infinitely more profound, as the hymn's chorus so poetically conveys in its first stanza and after a century of devotions. In reality, there is a whole cultural universe, rich in extraordinary characters, precise rituals and abundant stories, where the other essential component is the jarê, a local expression made up of entities and saints acting in a cosmogony in symbiosis with the garimpeiros of the Chapada Diamantina (Senna, 1998). This expression has fused numerous influences, notably African – of Bantu origin and Nagô culture -, Catholic and Amerindian (Banaggia, 2019; Teixeira, 2021). However, some local specialists refuse to equate jarê with a form of voodoo. Senna (1998) even argues that the jarê of *Lavras Diamantinas* cannot be considered a "religion of miners", as it is a

living and constantly evolving complement to the garimpeiros' universe.

According to this author, the different variants of jarê are nourished by the experiences of the garimpeiros, who have enriched them in return. According to this specialist, there are several influences of the diamond in the mythical body of the jarê ritual in Lençóis. Guanaes (2001) notes four that directly involve the diamond: its enchantment, its destiny, its call and, finally, its life. The first, the enchantment of the diamond, represents some "spiritual union with the stars". This mythical field is based on a magical triangle between a star, a diamond and a garimpeiro. For each star in the sky, there is a diamond within the Earth destined for a particular garimpeiro. No other miner will be able to find this diamond, as its star is unfavourable. Secondly, the fate of the stones dictates that the garimpeiro should ask the jarê officiant for clues to help him find the diamond that his lucky star has reserved for him more quickly. The third is the call, when the diamond invokes its future owner through light and sound: a sudden flash of light or an inexplicable noise are signs that the garimpeiro should be extra vigilant when washing the gravels, because his diamond is approaching. The fourth, which is very popular, is based on hundreds of stories that humanise the diamond, which knows how to observe, hear and smell miners. It hides from them and appears when it decides to (Guanaes, 2001). Banaggia (2019) sums up the diamond's rich fantastical activity in this way (translated): an existence of its own, capable of bubbling, growing, ageing, moving according to a particular will, announcing itself or causing appearances known as *livusias*. This author sums it up by talking about the conjunction of the "3Ds": *diamante*, *dono* and *dias* (diamond, owner, day).

This multi-faceted set of faiths and rituals was nurtured by the lucky few who kept hope alive for the vast majority of others. When a garimpeiro found a new abundance of diamonds, the whole Lençóis was warned and prepared to welcome these "nouveaux riches" to celebrate (hence the words *bem unidos*, all united, in solidarity). The lucky garimpeiros came down from the mountains to see their families in town, where they enjoyed their moments of glory and prestige. To celebrate such a major discovery, the merchants always had a stall open to sell the lucky ones festive foodstuffs at diamond prices, such as beer, oysters or canned lobster (rum, on the other hand, often flowed freely,

according to Furniss, 1906). Most of the time, they spent all the money they had earned on Ladies for an hour, parties, drinks, clothes and food (Guanaes, 2001). Guanaes explains that it was also a time for baptising children, sponsoring weddings, taking part in charity events and contributing to the church (translated) “because everyone wanted to take advantage of the *bambúrrio* that had taken place”.

6. The devil's game

More recently, the garimpeiro Gilson confided to Banaggia (2019, translated) “that he had already been lucky several times in his youth, being able to go a week or two without working, buy drinks for friends, give expensive gifts to ladies of their choice and throw parties with the best quality food.” This author sums it up succinctly as a “chronic ineptitude – even despairing for some materialists – for capitalist accumulation”! Of course, this cannot be generalised to all garimpeiros, but on the whole, many of these miners never became rich but exhausted themselves for the ransom of their lives and the accents of their faith. Many miners survived landslides or drownings: they bore the physical after-effects of the accidents they suffered (Banaggia, 2019). This can also be seen, astonishing as it may seem, as a stroke of good luck. That's why many miners in Chapada Diamantina said that even if they became rich – to the point where they no longer had to work in the mines – they would never give up life in the mountains. In fact, returning to the remote mining sites in the serra was about more than the search for diamonds – successful or not. These were also moments of absolute freedom, so long awaited by their captive ancestors. When they could walk alone in the forests and bathe in the waterfalls without fear of the matamores and their colossal dogs. Another version of this *Promise' Lan'* can be heard (among others) in the final chorus of Gershwin and DuBose Heyward's opera Porgy and Bess. Further, they were also precious moments when, in the secluded intimacy of an austere but temporary troglodyte hermit's *toca*, one would “talk to his ghosts” to “*botar a mão na consciência*” (literally “lay your hands on your conscience”; Guanaes, 2001).

As opposed to *bambúrrios*, there are “anti-*bambúrrios*”, such as the *pedra de raio* (*lightning stone*), locally known as *pedra de corisco*, which can cause a prospector to immediately interrupt his day (Banaggia, 2019). These particular stones, also known as ceraunia and whose tradition dates back to Roman times in Europe, are varied Earth-materials, but of singular appearance, strange and apparently incomprehensible: fossils (belemnite rostrums, shark teeth), picturial stones (landscape- and dreamstones), rock crystals caught in tree roots, fulgurites with

bizarre shapes, meteorites or, in the Chapada Diamantina, also prehistoric artefacts such as Amerindian bifaces known as "*machadinha de índio*" (literally "Indian hatchet"). According to many Lusitanian traditions imported to Brazil, they are supposed to have been brought here by lightning. They are said to be fantastically active, moving with the passage of time, making them uncontrollable and even frightening, which explains the fear they aroused in some garimpeiros. Furthermore, not honouring one's material commitments (including financial ones) is on a par with ignoring the influence of mysticism by forgetting one's vows to the church, the advice of the spirits (etc.), which can lead to *infuso*. This sort of spell that brings bad luck (Banaggia, 2019) psychologically weakened many of the "infested" miners, who became genuinely ill. However, the jarê healer often managed to restore the *infusado*'s health thanks to the right prayers that anneal the spell (Guanaes, 2001).

Indeed, the locals also know that "O garimpo é um vício, é um jogo do diabo" (Guanaes, 2001), mining is an addiction, a devil's game. Where, as they also believe, courage, strength and firmness are required. For the garimpeiros, the relationship between the mine and the devil is based on the imprecision and perfidy of chance, despite the hard work of excavation, which is not an "exact science". The scientific "laws of nature" and their corresponding techniques are not enough to guarantee success. There are always a few tricks up the sleeve to help find the coveted stone, but nothing can really guarantee a find. Worse still, the devil can triumph when conflicts between miners escalate rapidly while death is always lurking in ambush.

The life of diamonds in Chapada Diamantina does not end there, quite the contrary. Guanaes (2001) explains that many inhabitants of Lençóis were usually given diamonds, either singly or mounted in jewellery, when they were baptised, celebrated their fifteenth birthday, graduated or got married; and on any exceptional occasion, there was another "out-of-the-mine" 3D conjunction. The most precious diamonds from the point of view of international jewellery were resold. Many remained unsold, but their true value lay elsewhere, in association with the memory of the *bambúrrios*, whose origin and history were passed down from hand to hand, from memory to tradition, like a kind of mental talisman. A new magic then took place: these

diamonds became highly prized by those who received them. It was almost sacrilege, for example, not to wear these jewels to events or, worse still, to sell them (Guanaes, 2001). After centuries of several forms of thralldoms, I confess to being impressed by the lesson taught by this praise of the everyday, by this moral grandeur in which the value of precious objects is essentially immaterial, even if, as everywhere, the fragility of such traditions tends to be lost in our today's material reality, which tends to retain only the frivolity of a moment.

CASCALHO AND *CASCALHÃO*

1. The mines

Generations of garimpeiros have forged a large number of words specific to their experiences, including regional variants (Babinski, 1897; Soares Miranda, 2015; Souza Silva, 2017). These lexicons form one of humanity's richest mining glossary. The most endemic are *ballas* and *bagagens*, two names of Luso-Brazilian origin since they were first observed and described in Brazil. The former are still called by this name: they refer to what garimpeiros pragmatists call rifle bullets (Figure 43). The latter clearly seem to refer to the old hat trunks. In contrast to *ballas*, *bagagen* is so forgotten that I must present an old label proving it, via their francization as “baggage” (Figure 44). But we need to recontextualise these terms in terms of our current, more scientific vision. The former are also referred to as sectorial spherocrystals with radial fibres (Pavlushin *et al.*, 2020), but this explicit length means that the word “ballas” (or “balas”) is still favoured by usage. The latter are now called cuboids (Rondeau *et al.*, 2004).

More generally, the two terminologies – the garimpeiros' historical terminology and the scientists' current terminology – do not necessarily overlap. They are even the source of a great deal of confusion, as the geological understanding of the time had not yet reached the level we have today. What is more, there are many dialectal variations depending on time and place, so a word often changes meaning. Various explorers in the 19th century (Saint-Hilaire, 1830; Castelnau, 1850; Burton, 1869; Gorceix, 1882; Bovet, 1884; Babinski, 1897) describe diamonds as being found in particular sediments that are more or less coarse, clayey and heterogeneous, forming diamond-bearing layers that the locals call “*cascalho*” – literally “gravel” – which may be indurated (Figure 45) or loose (Figure 46).

Figure 43 . A rare carbonado ball, by far the strongest natural substance known: grade 42 on the Mohs scale extrapolated by Wooddell (1935). Half-nodule seen from the outside (left) and in its section (right, where its inventory number was painted). Note, on the left, the crystalline points similar to those described by Des Cloizeaux (1874). According to Pavlushin *et al* (2020), this is an archetypal ballas, i.e., a sectorial spherocrystal without a core and with radial fibres. Origin: Lençóis, Chapada Diamantina, Bahia, Brazil. W x H: 8 x 6 cm. Paris, MNHN, mineralogy, inv. 65.116. Photo: © François Farges/MNHN.

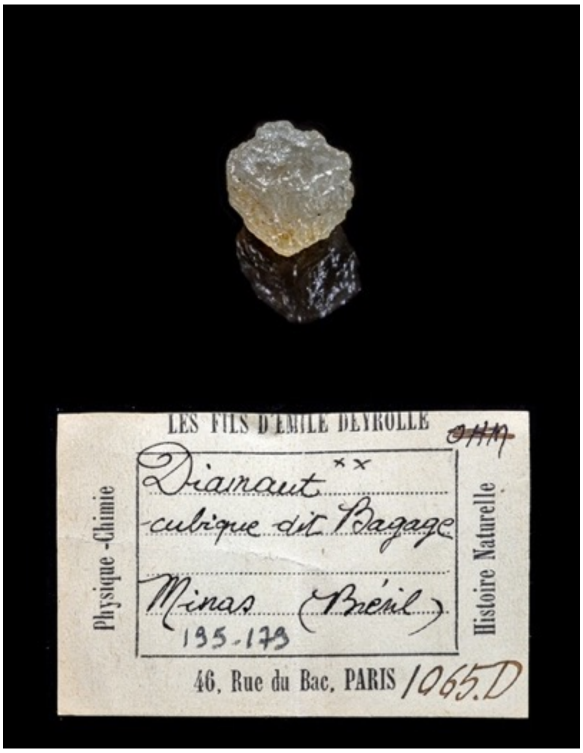

Figure 44 . The garimpeiros have invented a diamond language so rich that it can be found every day when you look for it. This diamond cuboid is labelled as (literal translation) "Diamond cubic known as Bagage" (probably a francization of bagagen), probably in reference to its square shape. The sample is enlarged 10 times in relation to its label. W x H x D: 3 x 3 x 4 mm. Bequest from Colonel Louis Vésignié. Paris, MNHN, mineralogy, inv. 195.179. Photo: © François Farges/MNHN.

According to these authors, the sterile layers of clay and coarse metaconglomerate (*gorgulho*) should be excavated more often in the less eroded areas between the valleys in order to gain access to the layers of mountain diamondiferous gravels *(tauá*). Each one has a depth of between 0.5 and 2 m. They also report that many excavations are dug below a *gorgulho* that is often left in place because it is too thick.

Figure 45 . Specimen of tenacious diamondiferous *cascalho* (neoconglomerate of the *canga de diamante* type) with detail (on the right) on the diamond crystal, Diamantina region (Minas Gerais, Brazil), 12.3 x 9.1 x 4.8 cm. Gift of the Brazilian Ministry of Agriculture, 1917. Paris, MNHN, mineralogy, inv. 117.343. Photographs: François Farges/MNHN.

Only the basal part of the *cascalho* is diamondiferous because natural erosion has concentrated the diamonds by gravity. Finally, below the *cascalho* is the *pissara*, which includes all bedrock. The nature of this rock varies greatly from one place to another, ranging from conglomerates to clays and sandstones. It can be soft or compact, schistose or gravelly, red or white (Souza Silva, 2017; Lima *et al.*, 2022). It is above all sterile in diamonds (this is its criterion) because its fragility does not allow it to trap diamonds, with some exceptions: Castelnau (1850) points out that some *pissara* are more tenacious (conglomeratic), and even form ancient giant potholes (*caldeirões*) that are locally enriched in diamonds. Apart from their potential confusions, these ancient authors observed that the dominant mineral species vary from one point to another, especially from one river to another. They clearly understood that these deposits are detrital, i.e., composed of gravel, sand and clay brought from elsewhere through alteration and erosion by atmospheric agents (water,

oxygen, rain, wind, etc.). Nevertheless, they interpreted them as superimposed strata as in a sedimentary basin (these deposits are currently described differently, as will be discussed in the penultimate secret on the science of carbonados).

Figure 46 . A very rare 19th-century *cascalho* from the Diamantina region (Minas Gerais, Brazil), gem-rich, diamond-rich and gold-rich, one of the very few specimens that still contains diamonds (the overwhelming majority of other collectible *cascalho* have had their gold and diamonds removed by miners). It was "stabilised" with underneath glue in a transport box when it was extracted (10 x 11 x 4.5 cm), as are the details of its contents: note the wealth of gold nuggets and two fragments of sub-recent *canga-type* conglomerate (top right) or red sandstone. The case is labelled "*favas*", (broad) beans, which also means – in garimpeiros dialect – the dozen or so yellow to orange to brown pebbles, some of which are composed mainly of gorceixite (Hussak, 1906). They tell the miners about the potential for diamonds, three crystals of which can be seen among a procession of black schorl, light brown anatase, rutile, magnetite, cordierite, kyanite, hematite, xenotime, monazite, etc. Note the absence of feldspars but also the curious relative rarity of quartz. Watch out diamond crystals (4 of them) but beware of colourless anatase and rock crystal! Gift of Catão Gomes Jardim, engineer in Diamantina (1890). Field of view: 8.1 x 5.4 cm. Paris, MNHN, mineralogy, inv. 90.28. Photographs: François Farges/MNHN.

2. *Os garimpos de carbonate*

From the garimpeiro's point of view, diamondiferous *cascalho* was found in two main areas: the mines located in the mountains (*serviços da serra* or *de morro*), which extend from the peaks to the escarpments on the mountainside, and the large-scale mines on the mid-mountain plateaux (*serviços do campo* ; Figure 47), followed by the lower deposits, the *serviços do rio* (Figure 48). Like all historical deposits, the latter were exploited first. This led the first authors to generalise river mining as a generality in the mountains, which took me a long time to recontextualise. The increasing scarcity of river diamonds then caused mining operations to move to more inaccessible areas in the mountains, where the soils are more arid and less suitable for food plantations. This depletion of the soil, both for mining and food production, often led to the desertification of these areas.

In all these *"cascalho" mines*, the various types of diamondiferous sediments may outcrop or be buried up to twenty metres beneath a sterile alluvial soil cover (often black or lateritic). They are mined using specific methodologies during well-chosen periods. These operations were usually temporary: extraction during the dry season – often from June to October and December to January – and washing during the rainy season. Like farming, they were synchronised with rainfall (Mangili, 2023). They are often limited (trenches or metric wells here and there) and chaotic due to the weakness of the technical means used, inherited directly from the colonial past, a situation deplored by Babinski (1897) who, as a man of his time, did not perceive the environmental devastation that these recommendations could cause (see the eleventh and final chapter).

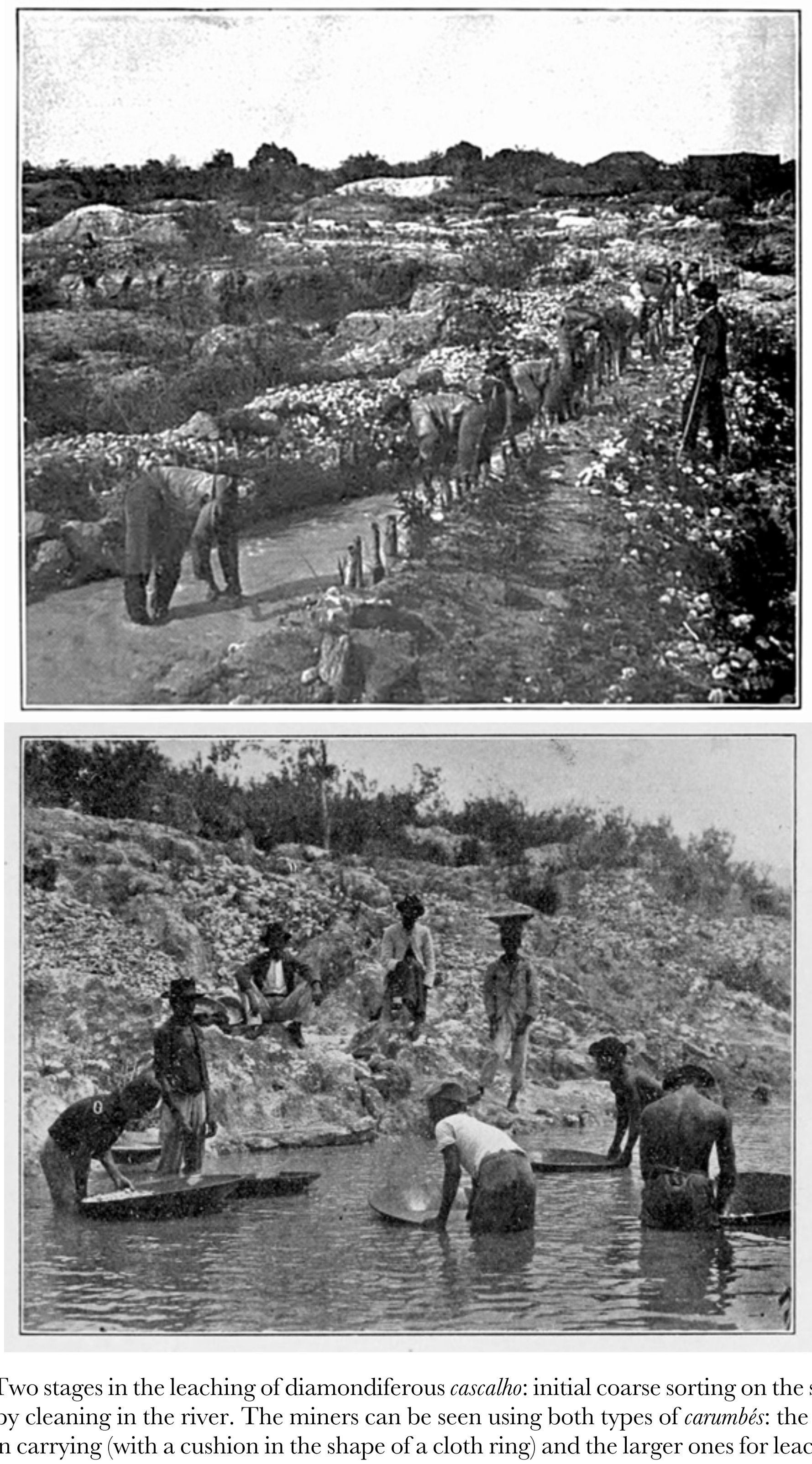

Figure 47 . Two stages in the leaching of diamondiferous *cascalho*: initial coarse sorting on the site, followed by refining by cleaning in the river. The miners can be seen using both types of *carumbés*: the smaller ones for cephalian carrying (with a cushion in the shape of a cloth ring) and the larger ones for leaching (batées) under the supervision of an employee of the owner. Source: Derby (1907, pp. 218-219) after Furniss (1906, p. 277); archive.org.

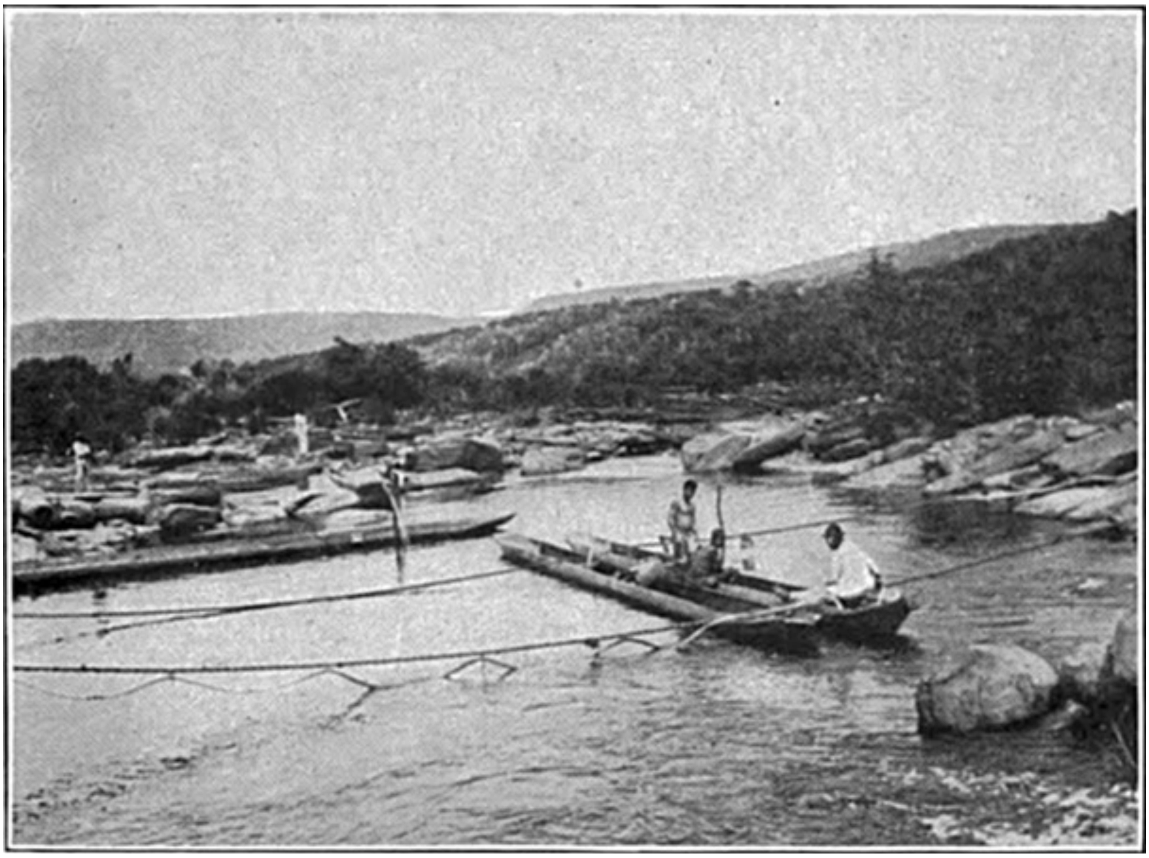

Figure 48 . River extraction of gravel around 1900, down the mountain grupiarras. Photograph by H. W. Furniss (in Derby, 1907, p. 218-219). Source: archive.org

3. From plateaux to rivers

In detail, there are around ten types of garimpo (Figure 49), although they sometimes overlap and their definitions vary according to the garimpeiros, history and places studied.

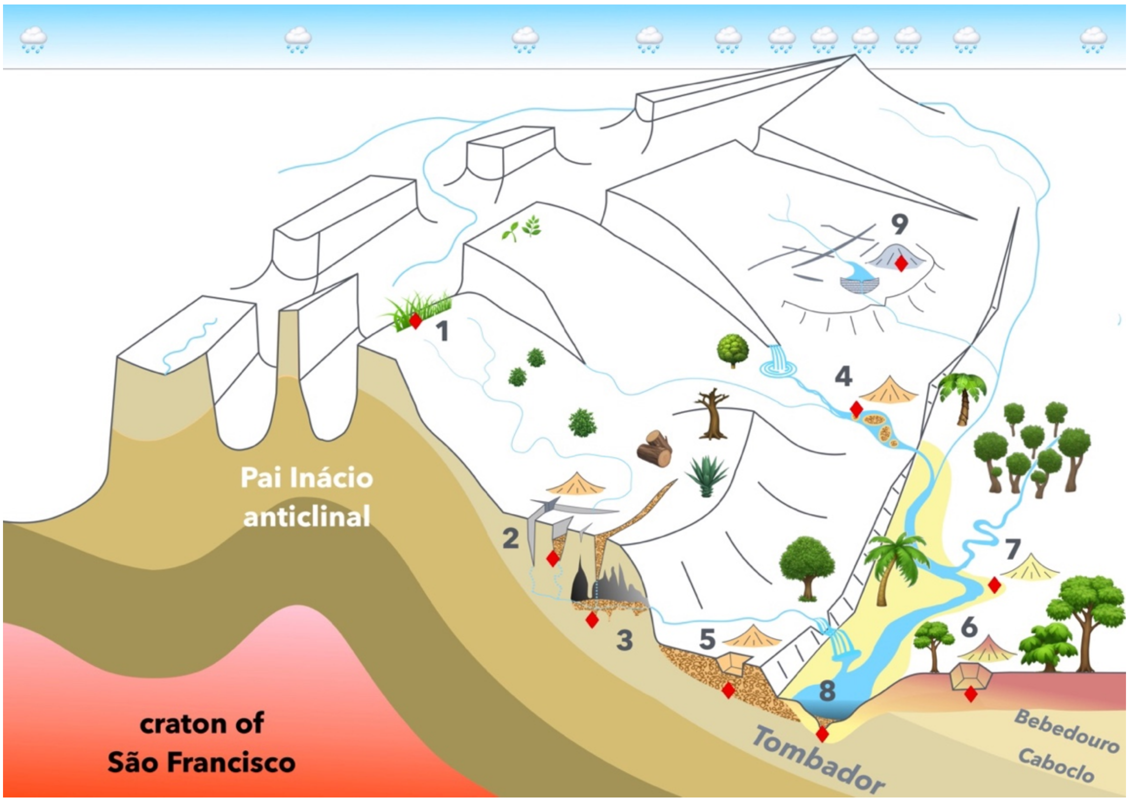

Figure 49 . Simplified geological and mining summary of the Lençóis-Igatu diamond zone (not to scale). In pink-red, the crystalline rocks of the continental base (São Francisco craton); in shades of beige, the very ancient to less ancient Precambrian detrital metasediments (conglomerates, sandstones and clays) – including the presumed diamondiferous Tombador formation – forming the north-south trending Pai Inácio anticline. More recent formations are shown in lighter browns (Caboclo and Bebedouro). Erosion of the anticline isolates the *morros* and reveals a double network of almost orthogonal fractures, oriented approximately north-south and east-west (grey). Its hydrological washout forms a parakarst (silicic) with diaclases (arranged in subrectangular "lunchbox" patterns) and caves. Since the Cenozoic, erosion of the whole area has deposited a variety of sediments (in yellow), including current anthropogenic sediments. The types of historic mines are marked with a red diamond (a diamond in different *cascalhos*, in mottled) according to geology or technique: 1 *nas raizes di capim* (in the roots of grasses, implied outcropping in the high plateaus); 2 *grupiarra* (*serviço de serra* on the surface); 3 *gruta* (cave fed by the karstic network); 4 *curriolo* (torrential gravels particularly in the *caldeirões*); 5 *cascalhão* (gully/trench in the debris of detrital rocks, diamondiferous at their base) ; 6 *barranco* (trench in laterites and then fine fluvial sediments of the buried palaeochenal type); 7 surface placer in a meander (current channel); 8 *scafandro* (in *poções* at the bottom of the river and exploited by diving); 9 *faisqueira* (small daily work of various types, including in old spoil as shown here in grey and with a small dam nearby). Summary partly based on Nolesco (2002), Pedreira (2002), Funch (2004) and Souza *et al.* (2021).

These include *nas raizes do capim*, *grupiara* and *gruna*, and even *engrunada*, as well as *gruta*, *curriolo*, *cascalhão*, *barranco*, *scafandro and faisqueira,* to name only the most generic, as there are many other names, as we shall see below, as this particular glossary is copious. However, if historically, the epicentre of mining activity has generally moved from the rivers towards the mountains, geologically speaking, it is the opposite that needs to be examined in the light of the effects of atmospheric agents subject to the laws of gravity. On the high plateaux, diamonds were sometimes sporadically found *nas raizes do capim* (in the roots of the grass), i.e., flush with the ground or in quartz gravel, or even in the crevices of high-altitude outcrops. Far more important, the *serviço de serra* are active during the rainy season by capturing run-off water via reservoirs held by small dams (Figure 47 top). The diamond-bearing ore is made up of loose mixtures that can be mined and vary greatly in composition from coarse, heterogeneous gravels to more or less clayey red earth and, when luck is on its side, minerals ancillary to diamonds, its "satellites", which herald the coveted adamantine mineral.

The *serviço do campo* are considered to be the most important and richest, exploiting various "veins, fissures and basins" as well as caves. Furniss (1902) mentions crevasses and gullies filled with debris from upstream, the deepest levels of which are the richest in diamonds, but which are more difficult to mine, or even quickly abandoned due to excessive water infiltration and the presence of harder rocks. These geomorphological traps, which mainly cut into the plateaux, are essentially made up of diaclases, which are large fissures in the conglomerate formed by run-off and dissolution by rainwater. The diaclases and caves were gradually filled in by colluvium (slope deposits), which drained diamondiferous sediments from upstream. The diaclases are mined open-cast, but quite deeply, sometimes underground (*gruna*) depending on the technology available. These *grunas* or *engrunados* are mining cavities dug sometimes via galleries dug into the barren rock. These operations require lanterns (*candeia*) and bags to extract the gravel. They are among the most dangerous, particularly when large clouds gather over the garimpo and the miners working underground are unaware of this. Torrential rain then falls on the mountain and floods the galleries, making it difficult, if not impossible, for

the miners to evacuate: many miners have disappeared as a result (Guanaes, 2001).

Similar dangers threaten the exploitation of natural caves, the *grutas* also known as *lancheio de arrasto* according to Gonçalves (1984). These caves, also formed by hydrological circulation but of greater volume, are sometimes kilometres long. Underground watercourses have deposited *cascalho* in them, sometimes in rich pots or on levels barely buried in the cave floor. They can be enlarged by felling, via lateral access galleries, which largely destroys them. The caves are often too small for adults to explore, so children are sent to explore these confined areas. These caves, which were naturally rich in diamonds, were much sought-after between the end of the 19th century and the beginning of the 20th century: many prospectors found them extremely rich in places (Guanaes, 2001). In some cases, barely buried diamond "beds" were so rich that the gems were harvested "by the bowl", as in the case of Lapão, which was memorable for its richness (Guanaes, 2001).

This richness is perceived differently by Europeans: Babinski (1897, p. 23), referring to a cave mined near Igatu, states (translated): "An experiment on 600 litres of cave *cascalho*, carried out in front of me in the Bom-Sera cave, yielded 2 carbons weighing 18 grains together and 3 diamonds weighing 5 grains together, i.e. approximately one tonne of gravel to be sieved to obtain 1.2 grams of black diamond and 3 diamonds weighing about 0.11 grams each." In other words, around a tonne of gravel had to be sieved to obtain 1.2 grams of black diamond and 3 diamonds weighing around 0.11 grams each... And he concludes: "I need not say that we have come across a particularly rich spot" (!) This "richness" is also questioned by Jacobs and Chatrian (1884, p. 185): "The same applies to the Roncador [rio], four leagues from Lençóes.... Some miners, led by Mr Antonio Gomes [de Azevedo], planned to empty some of them... They dug a hole about 100 metres in circumference, and more than a hundred slaves worked on it day and night... The work progressed, however, thanks to the efforts of the slaves, spurred on, alas, by the whips of the overseers. After four weeks, they reached the layer of diamond-bearing sand, which they quickly removed, stealing, as it were, from its bed. This gigantic task had cost 60 contos de reis (about 180,000 francs), but the rich treasure, the fruit of so

much labour, was finally in possession. They washed the *cascalho*, in which they were sure was the just reward for so much work and expense! All that was found were three defective stones worth 18 francs between them. The Antwerp authors add: "This, you may say, is an exceptional piece of bad luck. The miner encounters similar bad luck all the time. How many earth dismantling operations do I know of that have required two or even three months of work and sacrifice, and that in the end have yielded nothing but a little carbon [carbonado] or scrap." With other words, if a bowl full of diamonds can be seen "in whole shovelfuls", it actually means that, in this very particular context, an armada of miners has spent so much time and energy on it that only slavery and other forms of servitude, as well as extreme poverty or starvation can force such almost unimaginable endurance. Guanaes (2001) adds that although this type of mine can no longer produce diamonds because every accessible nook and cranny has been combed, the garimpeiros believe that there are still mineralised cavities in holes so inaccessible that dynamite would have to be used to access them.

In the mid-range mountains, deposits in smaller (less than one metre) and (almost) outcropping fissures – *grupiarras* or *gupiar(r)a* – exploit *cascalho de rapa* when they are only centimetric in strength. These are other diaclases mineralised by diamondiferous sediments that are mined from small terraces on the hillside via steep ravines, where there is a certain danger of collapse if the mine is not properly consolidated with appropriate props as ones mine deeper into the diaclase. *Cascalho* is more rolled here than at higher altitudes, and is sometimes referred to as "*gorgulho acascalhado*". It is found naturally in the erosion debris of these diaclases below the mountains, where it forms alluvium covered by a pedological blanket (soil). It can agglomerate on the surface thanks to a ferruginous cement, forming indurated crusts (*canga*) that can also be diamondiferous. Many specimens referred to in mineral collections as "diamondiferous conglomerates" are in fact *cangas* de *cascalho*. These eroded gravels were also mined in large man-made trenches known as *cascalhãos*, with walls that were sometimes 15 to 20 metres steep and dangerous because they could be poorly stabilised, since water was used to demobilise the sediments. In the absence of water, *barranco catra* are mined on slopes and dry ravines: they

measure between thirty and forty square metres.

Rapidly emptied by their exploitation, all these mountain geomorphological traps become long, narrow artificial spaces that no longer form water reservoirs and drain gently throughout the year, ensuring a relatively constant hydrological flow, particularly during the dry season and even during periods of drought. Conversely, the excavation of these loose sediments (gravel, clay and earth) acts as a powerful hydrological drain, contributing to flooding in the rainy season and drying up in the dry season (Nolesco, 2002).

In the valley, we find the oldest type of mining: *scafandro*, *escafandro* or *garimpo de mergulho* (diving mine), which mines diamond-bearing sandy to gravelly deposits at the bottom of rivers (Figure 48). These diamond-bearing sediments are located at a depth below the water's surface varying from a few centimetres to 20 to 30 metres, which means that rivers have to be diverted. The miners dive in boats to bring the fluvial *cascalho* to the surface, including at great depths (*veios*) to reach the pots, cauldrons and other traps more or less deeply sedimented among the barren alluvium. According to Furniss (1902), around twenty men dive in the shallowest places, and this number rises to around a hundred during the dry season, and even more when there are periodic droughts.

Many drowned because of faulty diving bells (Benenson, 1970). This process was used more in Andaraí than in Lençóis, where the rivers are shallower and therefore more easily exploitable by air (Guanaes, 2001). Here too, the *cascalho* is highly rolled, also mixed with quartz and clay gravel, although it was deposited in geologically relatively different conditions to that mined in the mountains. Diamond is also found in placers located at riverbanks, meanders, confluences and other channels, both current and ancient, forming *bacias* (basins), including in marshy areas (*brejo*). *Barrancos* are other types of hydraulic mining along faces or trenches, mainly in oxisols (laterites) in valleys. To reach the diamond-bearing zone, they are often deep, up to 20 m, and generally located near the banks of river valleys or in patches of around 400 to 600 m. These man-made gullies widen the river valleys and release clay downstream. *Cascalho de mocororo* is found at the very bottom of the

hills. It is the result of previous mining activities, particularly in the mountains, and has contributed to the silting up of the Sao José valley below. Some of it is diamondiferous, as some stones may have escaped the notice of former miners. They form placers that are mined in riverbeds, often at depth because they are covered by more recent waste rock. Jacobs and Chatrian (1884, p. 185) describe the São José river, which flows from north to south along the eastern flank of the Serra do Sincorá (Figure 31): "The banks of this river alone have been mined; its bed must be very rich in diamonds; but since it has been filled in with sand from neighbouring mines, it would be impossible to reach the *cascalho* bed without the help of machinery, which cannot be brought in for lack of roads".

Between mountain torrents and valley rivers, other geomorphological structures can be formed to trap diamonds. These deposits (*curriolo*) are formed within giant torrential pools (*caldeirões*), wells (*poçaõs*), trenches (*canae* or *canão,* long narrow natural bulges within watercourses) or sunken meanders (placer *per se*). Some *calderas* are said to contain up to 10,000 carats of diamonds (Bovet, 1884).

There are various "dry" operations known as *monchão* and *talhado*, which exploit natural fissures or trenches filled with clay and/or gravel, respectively. Finally, *faisqueiras* are rapid explorations, often of previously exploited areas (overburden). This type of small-scale surface mining is the simplest, as it requires little equipment (a sieve and a shovel) and no water (*a seco*). It is also practised at weekends, even as a hobby or by beginners extracting small diamonds (Souza Silva, 2017). Many carbonados discarded before 1870 were found in this way (including Sergio, see Chapter "1895: a fabulous discovery"). Above all, those who practised the *faisca* (or *fasqueira*) were not recognised as *garimpeiros*, but as *faiscadores*, and should not be confused (Guanaes, 2001).

Large diamonds, both gem and black, tend to be found in the higher deposits, but they are relatively rarer there than in the *grupiarra* deposits and especially in the river deposits, where the crystals are less rare but smaller. This is because the large stones have been trapped upstream because of their weight. Or have been cleaved by impacts during the chaotic phases of their transport, such as during storms and, in particular, via the so-called debris flows (which

are not the classic scree of gravel but behave like a voluminous, fluid, swift flow that rolls down the slopes, extremely dangerous for life).

4. The natures of *cascalho*

Figure 50 . Eight of the twenty or so different *cascalhos* from the Chapada Diamantina that were collected by Henri Jacobs (Jacobs and Chatrian, 1884) around 1880 (MNHN inv. GG □1237). From left to right and top to bottom: red *cascalho* “of the Serra”, *cascalho malacheta* from the “Vincino”, *cascalho* from the “Spinola” cave, *cascalho* of the (rio) Roncador, *cascalho* from the “rio Paraguapa” (with “cabocle”, orange-brown, haematite and gorceixite), *cascalho* (de) mocororo (locality not specified), *cascalho* from the “Vincino” after washing, so-called (translated) “black residual of the pan” (locality also unspecified). The various places mentioned have not been precisely identified. Photographs: © François Farges/MNHN.

Garimpeiros have developed a remarkable naturalist's eye, sometimes far better than that of many experts. Indeed, this “art of the garimpo” has its own specific expertise that can only be acquired through practice, combined with meticulous, repetitive observation. As well as rolled rock debris including metaconglomerate, jasper, flint, itabirite (a hematite rubbed with silica) and itacolumite (a micaceous and above all porous sandstone, which makes it flexible when cut into slabs), the different types of *cascalho* contain around forty isolated minerals, automorphic crystals or pebbles, for which the garimpeiros have also created a particularly rich pictorial glossary.

Fortunately, the MNHN conserves a rare and precious series of cascalhos from the Chapada Diamantina, which were collected by Jacobs around 1880 (inv. GG □1237 ; Figure 50). They show the great geological diversity of these detrital materials, from their rough (*serra* and *rio*) as well as the result of their washing with a *batéia* (diamond-panning).

As a result, these identifications are essentially visual and are therefore susceptible to variation, and even to the overlap of several similar species. What is more, their historical and semantic study is more complex than expected: the various scientific publications of the time that attempted to rationalise these names (Damour, 1856; Gorceix, 1881; Bovet, 1884; Hussak, 1906, etc.). The descriptions and identifications are far from consistent, even with more recent work (Soares Miranda, 2015; Souza Silva, 2017, etc). Cross-analysis of French, English and Brazilian sources shows that these names varied in time and space (dialectal variations between Minas Gerais and Bahia, for example). Lastly, in the second half of the 19th century, certain mineral names that originated with the European Enlightenment were still in use, such as “titanium iron oxide”, for which Dufrénoy (1855) had already complained that it was still used, particularly by miners, to designate various mineral species that are quite different. But he did not precise them (from ferrous rutile to titaniferous haematite – or magnetite – via ilmenite).

Figure 51 . Selection of 12 of the 22 paper folds by the engineer Armand de Bovet (1884) collected in March 1884 at Diamantina (Minas Gerais) which show the washed gravels, separated and identified according to the garimpeiros nomenclature for diamond accessory minerals (*formações*) in mountain (*grupiarra*, top line) or river (bottom lines) *cascalho*. Respectively, from left to right: (top line, *grupiarras*) *favas* (gorceixite), *osso de cavallo* (sillimanite), *captivo* (should be written *cattivo*) *de cobre* (rutile anatase pseudomorph), *liricoria* (should be written *siricoria*; here, monazite); middle line (river): *favas* (gorceixite; note a sillimanite gravel), *feijões* (implied *preto*, schorl), *agulhas* (rutile), *caboclo* (here itabirite jasper/red haematite); (bottom line, suite of river gravels): *pedra de anil* (lazulite), *esmeril* (inscribed "tourmaline?" but black haematite), *palha de arroz* (kyanite) and *esmeril de tinturia et ouro* (finely divided magnetite and native gold from the bottom of the pan). Paris, MNHN, mineralogy, inv. MIN2009-2171 (x 8 paper folds), MIN2009-2185 (x 7) and MIN2009-2189 (x 7). The paper folds measure an average of 4 x 2.5 cm. Analyses, identifications and photographs: © François Farges/MNHN.

As luck would have it, the mining engineer Armand de Bovet, in fact Jean Louis Marie de Bovet (1851-1908), donated to the École des Mines (School of Mines) and the Muséum d'histoire naturelle (Museum of Natural History) in Paris batches of minerals, loose or selected, found in the bottom of the threshing floor after washing of the *cascalho* by the garimpeiros of the Minas

Gerais region (Bovet, 1884). The second batches, kept at the Jardin des Plantes in Paris, are dated March 1884. They have obviously remained untouched since then, as they were not inventoried but kept with many other diamondiferous sands in a dedicated drawer that clearly held little interest for those in charge of conservation, who were more interested in aesthetic crystals (and that's it). They were recently rediscovered thanks to a computerised inventory of the collections (Figure 51), they constitute the rare historical specimens known to date that enable the current mineral species to be rigorously identified using the vernacular and pictorial names used by the garimpeiros in this part of Brazil at the time.

These are therefore invaluable treasures, the last vestiges of a rich culture that has been all but almost forgotten since the garimpeiros traditions built up over previous centuries were abandoned in the 20th century. Reasoning with this lexicon from Minas Gerais (and not Bahia) is a challenge, inevitably fraught with irregularities because of the many dialectal variants. However, some fairly invariant major classes of minerals stand out (Damour, 1856; Gorceix, 1881, 1884; Bovet, 1884; Babinski, 1897).

First and foremost are the indicators of the diamond's imminent arrival, known to the miners as *cattivos* or *escravos do diamante* (diamond captives or slaves). Semantically, it is disturbing to see how the garimpeiros, essentially slaves until the 20th century, linked the notion of slavery and captivity – which they suffered every day at their expense – to that of a companionship observed in nature, which nevertheless heralded potential wealth and, above all, the official emancipation they so sought through mining.

Back to mineralogy, these phases include colourless spinel, but also *cattivo preto* ("black captive", rutile and/or ilmenite) or *cobre* ("copper captive", pseudomorphosis of sphenohedral anatase by rutile). Among the much sought-after heralds of diamonds with higher density than quartz, there are also *feijões pretos* (black beans, schorl), *favas amarellas* (yellow beans, jasper or hydrated phosphates including gorceixite or *cabocle* or even florencite-Ce; Hussak, 1906), *favas pardas* (brown beans, ferrous gorceixite or altered senaite?), *siricoria* (or *sirecora* or *sericória;* any translucent to transparent crystal such as anatase, topaz, euclase, monazite, chrysoberyl, etc.) and *agulhas* (rutile). Around thirty other

accessory minerals complete this list, which forms the *formação* (formation, understand paragenesis) and includes other *feijões preto* (biogenic black jasper or lydite), *esmeril de tinteiro*, de *lustroso* or de *caboclos* (varieties of haematite and even magnetite, including micro-sandstone for *tinteiro*), *palha de arroz, verga de aço* (rice straw and steel rod, kyanite), *osso de cavallo* (bone of horse, sillimanite), *caboclas lustrosas* ("limonite", goethite with other iron oxyhydroxides), *vidros* (xenotime), *(pedra de) anil* (lazulite), *estrel(l)ado* (large boulder conglomerate), *pedra Sant 'Anna* (St Anne's stones, pyrites "limonitised" with goethite), *pipoca* (limestone concretion), sphene... Others are variable: *caboclas vermelhas* (either red haematite or cinnabar), *pinga d'agoa* (drop of water, hyaline quartz or topaz), *ovo de pombo* (pigeon's egg, milky rolled quartz or chalcedony), *figados de cágado, de galhina* (turtle livers, hen livers; red chalcedony and jasper in more angular shapes), *malacaixita* (or *malacacheta*, muscovite-phlogopite mica, but also talc and even talcschiste). Finally, others are not clearly identified: *feijão chitado* (brown beans), *ferragems (do cobre, prato, de prata*, *azul*; copper scrap, black, blue etc.). Not forgetting *feijão simillante el carbonate* (a bean similar to carbonado), a kind of black pebble but visibly brighter than *feijão preto* or schorl.

Figure 52 . Miniature versions (between 8 and 16 cm long) of the main tools used by Brazilian garimpeiros (Minas Gerais art, before 1890); from left to right: *almocafre* (almocafre), *alavanca* (lever), *cavadeira* (spade) and *anxadão* (hoe). In reality, they are between 0.5 and 2 metres long. Gift of Catão Gomes Jardim, 1890. Paris, MNHN, mineralogy, inv. 90.28. Photo: © François Farges/MNHN.

For extraction, the garimpeiros used three to four main tools (Saint-Hilaire, 1830): the *alavanca* (lever), the *cavadeira* (excavator), the *almocafre* (hoe) and, later, the *enxadão* (hoe). The *alavanca* (Figure 52) is an iron bar about a metre long, with a wedge at one end (for extracting soft rock) and a quadrangular pyramid at the other (when the ore is more compact). The *cavadeira* is a straight iron tongue, sharp at the end and around 10 centimetres wide, which digs into the earth or loose gravel. The *almocafre* is a flattened, curved pickaxe whose width decreases from the base to the rounded end. Miners used it to gather up the excavated ore because the shovel was unknown at the time, which considerably slowed down extraction (Babinski, 1897). *Exadas* are also used for digging, *marrãos* which are large iron hammers for breaking stones and *ralos*, or *drains*, used to refine the gravel to be washed; a *frincheiro is* a kind of large trowel (finished in a triangle) used to extract diamond-bearing gravel from fissures known as *frinchas* (Martins, 2013).

These gravels, ready to be washed, form *ismiril* according to Soares Miranda (2015) or *esmeril* according to Souza Silva (2017), although *esmeril* is also a form of magnetite concentrate obtained after beating (De Souza Aguiar, 1904). Some miners imported a variety of mining techniques from Minas Gerais, including hillside canals known as *bicas*, set between an upper reservoir and a sunken inlet that can be sealed off (córrente das Bicas possibly refers to these canals, although *bica* also refers to a spout, a part of the sorter from which the fine part of the sediment is ejected; Soares Miranda, 2015). The *cascalho* is poured in, drained along these adductions, and the dense minerals are deposited at the end of the run. This first concentrate is then washed and more meticulously sorted.

Head-carried *carumbés* (Figure 47 below and Figure 53) are used to transport 4 to 15 kilograms of ore each time for a second sorting/washing operation (Bovet, 1884; Pereira, 1895). This name, derived from an Indian word meaning tortoise shell (Saint-Hilaire, 1830), applies to two types of bowls (or pans) used by miners to extract gold and/or diamonds. The first, about 30 centimetres in diameter, is shaped like a circular bowl with a rounded base (sometimes square with a bevelled rim). The washing operation uses a second type of bowl, the *bateia*, a pan, which is about fifty to sixty centimetres in

diameter and has a more pointed bottom than those used by gold panners (Gorceix, 1882; as can be seen in Figure 53) due to the lower density of diamond compared with the ones used for gold panning.

Figure 53 . Miniature versions of three models of *carumbés*: the smallest, with a round bottom, was used to carry all kinds of rubbish and the largest, a *bateia* (pointed-bottomed beater), was used for washing (here, 6 to 8 cm in diameter; in reality, around 50 to 60 cm). Don Catão Gomes Jardim, 1890 Paris, MNHN, mineralogy, inv. 90.28. Photos: © François Farges/MNHN.

These different *carumbés* are usually made from the fragrant red wood of cedar (Cedrela *odorata*), which is highly resistant to tropical humidity. Garimpeiros have defined various types of *cascalho* according to how they are used, such as *corrido*, *dobrado* and *ralado*: worked in water, raked and drained respectively (Gonçalves, 1984). Sorting is also done by hand (although electromechanical vibrating tables have already been used in South Africa (Furniss, 1906). This last stage is very closely monitored, but according to Francis de Castelnau (1850), half the diamonds are stolen here (I am not going to mention the horrible punishments inflicted by the guards known as *matamores*, literally "Moor killers", in the event of theft being discovered). Indeed, some miners developed techniques for shaking their sticks to hide diamonds from their guards (Banaggia, 2019). This is also the time when

miners incant *Nosso Senhor dos Passos* and the jarê saints to meet the *bambúrrio*.

Figure 54 . A *picuà* (10.1 cm long) containing a carbonado and a rutile, one of the minerals associated with diamonds in a sedimentary deposit (2.5 and 3.7 carats) from Igatu (north of Andaraí), donated by Mme Machado, 2000. Paris, MNHN, mineralogy, inv. 200.238. Photo: © François Farges/MNHN.

5. From garimpos to workshops

The average weight of black diamonds found in 1902 was around 6 carats, for a monthly production of 2,400 carats (Furniss, 1902). Those weighing 1-2 carats were the most prized, as they could be used as they were in industry without the losses caused by the fragmentation of larger stones (between 5 and 30% losses). Only 5% of production is considered to be of poor quality, and the mines around Lençóis produce the most (Furniss, 1902).

Figure 55 . A historic carbonado shear currently on display in the Hotel Canto das Águas in Lençóis (Bahia, Brazil). Credit: © Roy R. Funch (*with permission*).

The discovered diamonds are placed in a *picuà* (Figure 54), a sort of tube hollowed out of an overhanging *imbé* vine (*Philodendron imbe*) and used to transport the small diamonds to the town where sociability was established (Sales, 1955): mainly Lençóis but also Andaraí, where the traders and polishers wait for them every Sunday, *feira* day, the carbonados market (Serre, 1913). The largest specimens are broken into pieces weighing around one gram each using a screw crusher (or shearer) (Figure 55), which can manually exert

pressures of the order of 20 (metric) tonnes. Curiously, their price rises after fracturing, as the locals develop know-how in this area. This know-how must be sufficiently precise to produce fragments that are just centimetric, the most sought-after by industry at the time, while avoiding millimetre-sized pieces, or even powder, which cause financial losses.

Gem diamonds follow a different path. *Mosquiteiros* (*mosquitoes*, small diamond buyers) acquire *mosquitos* (mosquitos, small diamonds up to around 0.15 carat). This is just the beginning of a rich nomenclature of qualities: there are the *bons*, gem crystals, lightly coloured and of good dimensions; the *fazenda fina* are small and tinted but of good quality; the *melee* (or *mellê*) are not very gemmy and of poor colour; the *vitrie* (or *vitriar* or *vidrilhos*) are very small stones weighting less than 0,1 carat on the average and of all colours and very fiery. *Fundos* are broken crystals, too rich in defects and mixed with second quality carbonados (Furniss, 1902, p. 153).

In contrast, the buyers of commercial diamonds are the *capangueiros*, who buy the gems directly from the miners who need their intermediary and, above all, their trust to sell their finds to the cutters at the right price (Ganem, 2001; Banaggia, 2019). This name is linked to the *capanga*, which is a simple bag with a leather or denim strap worn over the shoulder. This bag was used to carry a few items useful to their trade, such as magnifying glasses and scales that enabled them to observe and value diamonds (Guanaes, 2001). It is in the *capangueiro*'s interest not to underestimate the price of a stone – and therefore his commission, but also the confidence of the garimpeiros – unlike the diamond dealer, who is more interested in optimising his costs. These *capangueiros* even form consortia of buyers to acquire the most exceptional diamonds. Some of these buyers quickly become major traders, known locally as *pedristas*, who are at the top of the hierarchy of buyers. They even resold the diamonds on foreign markets (first in Europe, then in the United States), which were far more lucrative. Alongside the patrician fazendeiros, they became the other diamond "aristocracy" (Banaggia, 2019). Like the latter, many pedristas even combined trade with investments in mining, cattle rearing and agriculture, concentrating wealth and power in the hands of a very small fringe of the population (Teixeira, 2021).

Figure 56 . View (2015) of the Praça Horácio de Matos (see also Figure 34) in Lençóis showing two types of buildings: one-, and two-floors (*sobrado-type*). Image: © Rafadelongo/Wikimedia Commons (CC BY-SA 4.0, slighly cropped).

According to Ganem (2001), these merchants met to buy from the miners in the *Sobradinho das Bicas*: a small *sobrado*, a typical patrician's house from this period whose two storeys underline the status of its owner (Figure 56). It was located between Piçara and Bicas (Figure 31), on the boundary between *Companhia* N°1 and Companhia N°2. In this *sobradinho*, auctions were held of lots of valuable gems ,first diamonds and then carbonados from the 1880s onwards. Each lot was enclosed in a paper where, as with the garimpeiros, luck was once again called upon. This was followed by celebrations with the families, to the sound of dances orchestrated by guest musicians. Ganem (2001) recounts a juicy episode from this place (which, alas, we do not know whether it is a documented historical fact, an oral tradition or its novel version). Such as that of a miner who offers for sale a priceless ballas wrapped in paper and which, as usual, nobody sees. Unfortunately, the bidding doesn't go up, as it is suspected that the ball is a rifle bullet (from which, incidentally, the word "balas" is derived). Mad with rage, the miner stuck it in the barrel of his rifle, fired the shot towards the mountain and lost the stone forever.

Faceting workshops were numerous, but the results were judged to be

fairly good (Ganem, 2001) or mediocre (Babinski, 1897; Furniss, 1902). As electricity was sporadic even recently, local diamond workshops used water mills as a source of energy (Benenson, 1970), which made it impossible, according to Babinski (1897), to obtain the precision demanded by the Parisian jewellers. Nevertheless, workshops developed actively under the impetus of Domingos Gomes de Azevedo (III) and his son Clemente on the site of the Roncador concession. They increased the concession's revenue (cut jewellery was more profitable than rough) and its production was bought by a famous gem broker of the time, Coronel (colonel) Uldurico de Magalhães Macedo.

6. The *mandubi*, or the forgotten *cascalho*

While many samples of *cascalho* from the lower reaches of the serras have been preserved (*canga-type* indurated lateritic duricrusts), this is not the case for *cascalho from* mid-mountain deposits. It seems to be different because, not surprisingly, the garimpeiros have given it a special name, *mundubi*. This word means "peanut" in Bahianese from the Sertão. But it was as rarely used as it was abundantly harvested, but never preserved as far as I know. The only mention of *mandubi* comes from Atahyde Pereira (1901, translated): "In the vicinity of Lençoes, in the Serra da Estrela do Céo on the road to Capão Grande, we have just found a carbonate embedded in one of these *mundubis* rocks, which must weigh around 15 carats and which has been very skilfully collected with part of the stone, which gives it immense value. It was bought by the capitalist Colonel Francisco de Mello for $1,500,000 and sent by him to Paris, without this gem being appreciated by the experts and collectors of these rarities. I wanted this stone to be drawn in the same way as the carbonate, emphasising its shape, so that it could be included in our Institute as one of the rarities of the Lavras Diamantinas; but when I decided to talk to the dealer, it was too late, as he had sent it to Paris and so this beauty went unnoticed by those who appreciated it, which would be an excellent idea to include it in our museums. But one thing is certain: our daring prospectors will no longer respect *Mundubis* rocks. They have learned their lesson."

This disillusioned speech by this great Brazilian writer refers not only to the "peanut stone", but also to one of the garimpos of Estrela do Céo (or Céu ; Figure 41); the "carbonate" is a carbonado and its drawing (which, alas, I have not been able to find, unless he is referring to the one in Moissan's publication (1895) six years earlier, which he mentions above this extract); the Geographical and Historical Institute of Bahia (IGHB in Salvador). The adjective "capitalist", means in this context a trader: Francisco de Mello exported "carbon" (carbonado) from Salvador (Herold, 2013). He sold the precious sample for 1 and a half contos de reis or, very roughly, €11,000 in 2024. It was therefore a not-so modest sample in terms of size (a 15-carat "black diamond") but also in terms of its matrix, that mysterious "peanut rock".

What happened to this exceptional sample, this “Rosetta stone” of black diamonds, after it was sent to Paris? I am still looking for it at the Museum, because I hope that a diamond dealer did not extract it from its gangue, reduce it to industrial-quality fragments and throw away the *mundubi*. So, if the garimpeiros learned that a mineral in its gangue is worth more than without its matrix (a principle still very valid today), none of them seems to have been preserved to my knowledge. This testimony, so tragic for the science because the specimen would have taught us so much more even if the name peanut seems to allude to quartz pebbles coated with tawny, powdery clay like those that exist in our drawers of Brazilian diamondiferous sediments but labelled *“cascalho”*. This story shows just how futile it is to fight the power of money between starving garimpeiros and venal traders who neglect the preservation of their own descendants' heritage. As with so many great black diamonds, Brazil – but also Great Britain and France among many others – failed to preserve many of these precious and unique specimens.

Jewellery Splendours

1. Royal treasures

Figure 57 . Examples of emblematic 18th-century Portuguese jewellery from Minas Gerais: bodice front decorated with cascades of small diamond brilliants (top left), imperial topaz (top right), amethyst (bottom left) and chrysoberyls (bottom right, with rubies and emeralds). Lisbon, Museu Nacional de Arte Antiga. Photo credits: © Manederequesens, Wikimedia Commons (Creative Commons Attribution-Share Alike 4.0 International licence, photos cropped and assembled).

The discovery of diamonds in Brazil contributed to courtly splendour between the 18th and the 19th centuries, not only in Portugal, but also in France, Saxony, Bavaria, Denmark and Russia, to name just a few of the most opulent and advanced monarchies. From the 18th century onwards, these

monarchies included not only a profusion of gem diamonds, but also coloured stones that had previously been rarely used outside religious ceremonies. Although the Portuguese colonists were initially looking mainly for emeralds, they soon found gold and diamonds, followed by beryls, tourmalines and peridots (green), as well as other gems such as amethyst and chrysoberyl, which Minas Gerais began to produce in relative abundance, not forgetting imperial topaz, yellow-orange to pink, the latter being known at the time as "Brazilian rubies". These gems were set in jewellery linked to aristocratic dress, both for men – leotard buttons, brandebourgs, hat hooks and other rings – and for women, notably for bodice fronts and other stomachers (Figure 57). Diamonds were also set on various more enduring symbolic objects of monarchs (*regalia*), such as coronation instruments including crowns, orbs, sceptres, epaulettes and other insignia of chivalry (Figure 58).

Figure 58 . Adam Gottlieb Pollet: Badge of the Portuguese Order of the *Três Ordens* (Three Orders) set with Brazilian diamonds, emeralds and rubies, which belonged to Queen D. Maria I of Portugal. Lisbon, 1789. Ajuda National Palace (Lisbon). Photo credit: Manederequesens, Wikimedia Commons (Creative Commons Attribution-Share Alike 4.0 International license).

2. The Parisian jewellery of the Golden Fleece

Throughout the 18th and 19th centuries, Brazil produced a few large crystals, but above all an abundance of small diamonds, many of them of excellent quality. These mines fed the workshops that produced large numbers of brilliants weighing a few carats (or less). They enabled jewellers to create jewels of poetic lightness, despite the hundreds of brilliants that make up these masterpieces.

Pierre-André Jacqmin (1710-1774), Parisian jeweller to King Louis XV of France and to the Crown of France, introduced a style that was both light and imposing, in which hundredths of small diamonds were paved to create supple shapes in the rocaille style of the period. His signature piece is the Great Insignia of the Golden Fleece, known to belong to the "parure de couleur" (the Colour Adornment) he designed for Louis XV (circa 1749), which is composed of two large blue diamonds (69 and 33 carats), a pink-red spinel known as the "Côte-de-Bretagne" (107 carats) and three yellow sapphires (together 26 carats). This avalanche of exceptional gems was framed by pavings composed of 482 small brilliants, according to the 1791 inventory of Crown jewels (Bion *et al.*, 1791). The jewel was crowned "*le plus beau bijou du monde*" (the most beautiful jewel in the world, Bapst, 1889). Shortly afterwards (Morel, 1988), Jacqmin created a second large insignia of the Golden Fleece, known as the "*parure blanche*" (White Adornment), consisting of four large colourless (or pale) diamonds weighing between 11 and 25 carats from from the Crown jewels inherited from the time of the Sun King (second part of the 17th century). All these diamonds are therefore Indian (and possibly Indonesian), as the Brazilian mines had not yet been discovered. These were set on three large palms making up the bezel, which was enriched with 171 small brilliants (including eight of around 2 to 4 carats) and 80 small rubies for the flames. Unfortunately, these masterpieces were stolen in 1792, and then completely dismantled by fences.

The only known illustrations are a gouache by Jacqmin (Farges *et al.*, 2008; Figure 59) and a pair of double-sided engravings by Bapst (1889, pp. 268 and 269) for the first insignia of the Golden Fleece. The modern reconstruction of the jewel can now be seen in the Galerie de Minéralogie at the Muséum

national d'histoire naturelle, thanks to a major sponsorship from Maison Boucheron in the heart of Paris' famous Place Vendome.

Figure 59 . Left: historical gouache of the insignia of the Golden Fleece of Louis XV in coloured finery by “Jacqmin fils” (Alexis). Centre: Pascal Monnier's gouache of the modern recreation (2007-2011) by Geneva jeweller Herbert Horovitz (right), based on the author's research (archives, casts). This “new Fleece” was acquired thanks to a sponsorship by the Maison Boucheron in 2021 to the MNHN and is since on display in the “Treasures of the Earth” exhibition at the MNHN. Gouaches: © private collection (with permission); photo © François Farges/MNHN.

The portrait of Louis XV by Carle van Loo (Figure 60) evokes the King's second insignia (because painters rarely reproduced jewels exactly, as they were generally executed back in the studio by assistants, from memory or via sketches). I have since found two jeweller's drawings of insignia of the Golden Fleece in the Bapst archives (Paris, Bibliothèque nationale de France, NAF18132) that seem fairly close to the 1791 description of the second, although set with gems that are apparently more modest in size (Figure 61).

These two impressive insignia for Louis XV established Jacqmin's Parisian jewellers (and their subcontractors) as the founding nucleus of its tradition of *haute joaillerie*, which developed throughout the 19th century with the even more complex creations of the First Empire, fuelled by the plethora of small Brazilian brilliants, for which France was still the largest consumer at the time. This delighted the English and Dutch workshops that produced them, some of which were run by the direct descendants of Huguenot diamond

merchants who had managed to emigrate following the disastrous revocation of the Edict of Nantes (1685) by King Louis XIV.

Figure 60 . Carle van Loo (1705-1765): Louis XV, King of France and Navarra, copy (3rd quarter of the 18th century) of the original presented in 1751 (which has since disappeared). Illustration reframed on the subject with an enlargement, on the right, around the insignia of the Golden Fleece, visibly that of the white finery but approximately depicted with regard to its recollection of 1791. Versailles, Musée de l'Histoire de France, inv. MV 3751. Photograph: © Музей Версаля; source: Wikimedia Commons (public domain).

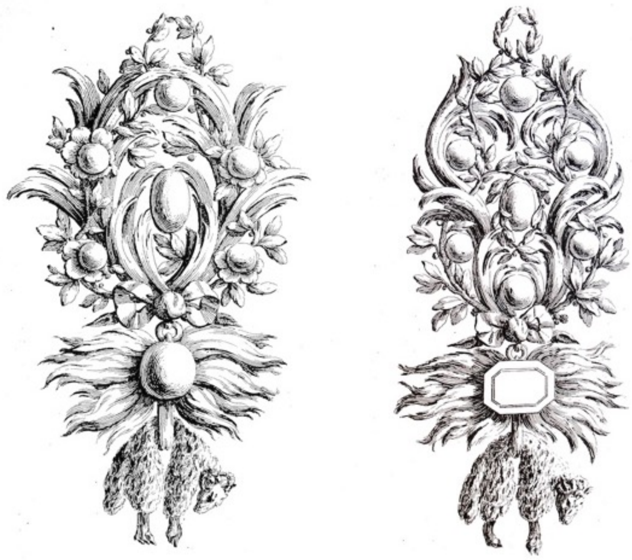

Figure 61 . Two drawings of the insignia of the Golden Fleece found in the Bapst-Falize archives (Paris, BnF, NAF18132, date unknown). These two insignias, in which the fleece is mistakenly pointing to the right instead of the left, seem to be inspired by, but less rich (number and size of the large diamonds) than the one designed by Jacqmin around 1750 for Louis XV, which appears to be recognisable on a portrait of the King in armour by Carle Van Loo (circa 1755), especially the one on the left. The one on the right is reminiscent of João VI's insignia, but in a more fluid design. Photo: F. Farges/BnF.

3. From Paris to Russia

Figure 62 . The two Orlov brothers, from left to right: the elder Grigori Orlov and the younger Fyodor/Fedor Grigorievich, from portraits by an unknown artist, late 18th century from an original of 1770, private collection – by Carl Ludwig Johann Christineck, 1768; Primorsky State Art Gallery, Vladivostok, Russian Federation. Below, the diamond of the same name: on the left, the 1767 engraving by Franz de Bakker; on the right: DiamCalc simulation of the Orlov diamond (estimated at 189.62 carats, 32 x 35 x 21 mm) presented by Grigori to Tsarina Catherine the Great before 1774, when it was set on an imperial sceptre, still kept in the Kremlin (Moscow, Russia). Credits: copyright free (Amsterdam, Rijksmuseum inv. RP-P-1911-2912); DiamCalc simulation © François Farges.

These creations set the tone for a highly virtuosic jewellery fashion that spread to many European courts, including, in addition to the Portuguese, the Bavarian, Saxon, Danish and Russian (with the British in the pipeline). Catherine the Great (1729-1796) had thousands of diamonds mounted for her magnificence, including the two imperial crowns (1762), still kept in the Kremlin and set with almost 5,000 diamonds. The most important is the thick,

octagonal, stepped front diamond, weighing 55.62 carats. It was appraised at 155,000 roubles in 1865 (Zimin, 2011), or nearly 4 million euros today, not counting the heritage value that has since been added, which can more than quadruple this estimate. But she is also known for the gifts of gems she received or gave to her subjects. The most famous of these was the Orlov Indian diamond (189.62 carats, Indo-Mogol *bullandi* cut; Figure 62), named after the Tsarina's favourite, Grigori Grigorievitch Orlov (1734-1783; we will return to this character and his younger brother Fyodor later). For decades scholars have debated whether the Orlov was originally the 280 carat Grand Mogol diamond (Tavernier, 1676; Figure 7), which was allegedly re-cut after the conquest and sack of Delhi and its Mughal treasures by the Persian forces of Nâdir Shâh on the 20th of March 1739.

By ousting a favourite, the race for diamonds – including those from Brazil – took an unexpected turn with the arrival of a new adversary hungry for gleaming stones: ten years her junior, Sergeant Major Grigori Aleksandrovitch Potemkin (1739-1791) helped the Empress in her coup d'état in 1762 against her consort, Peter III. Following Potemkin's additional great victories in the First Russo-Ottoman War of 1768-1774, the Empress's relationship with his sergeant major, who had become second lieutenant of the guards, became more intimate. Potemkin succeeded Grigori Orlov at the foot of the imperial bed.

4. The case of the Potemkin

Figure 63 . Unknown artist after Johann Baptist von Lampi the Elder (1751-1830): Portrait of Grigori Potemkin (Potyomkin) carrying a diamond-set portrait box of Empress Catherine II (before 1792). Warsaw, National Museum of Warsaw (Muzeum Narodowe w Warszawie, MNW), inv. M.Ob.783. Source: Wikimedia Commons.

According to Balfour (2008), Empress Catherine II acquired a second 54-carat diamond, which she wore for a time as a hair ornament and then gave to her new favourite, who became a prince and field marshal (Figure 63). The gem – which reappeared at the "Treasures of the Tsars" exhibition at the *Galerie Kugel* in Paris in 1998 and is now estimated at 54.12 carats – is reputed to be Brazilian, but its atypical faceting for Europe is reminiscent of the *para* of Indo-Mogol workshops (Figure 64), like the ninth diamond brought back by Tavernier for Louis XIV in 1668 (Tavernier, 1676). The 120 facets of the Potemkin are distributed mainly around its thick rim (a good hundred), with a further fifteen or so polished on the obverse. The reverse appears to have a smaller cleavage plane than the obverse.

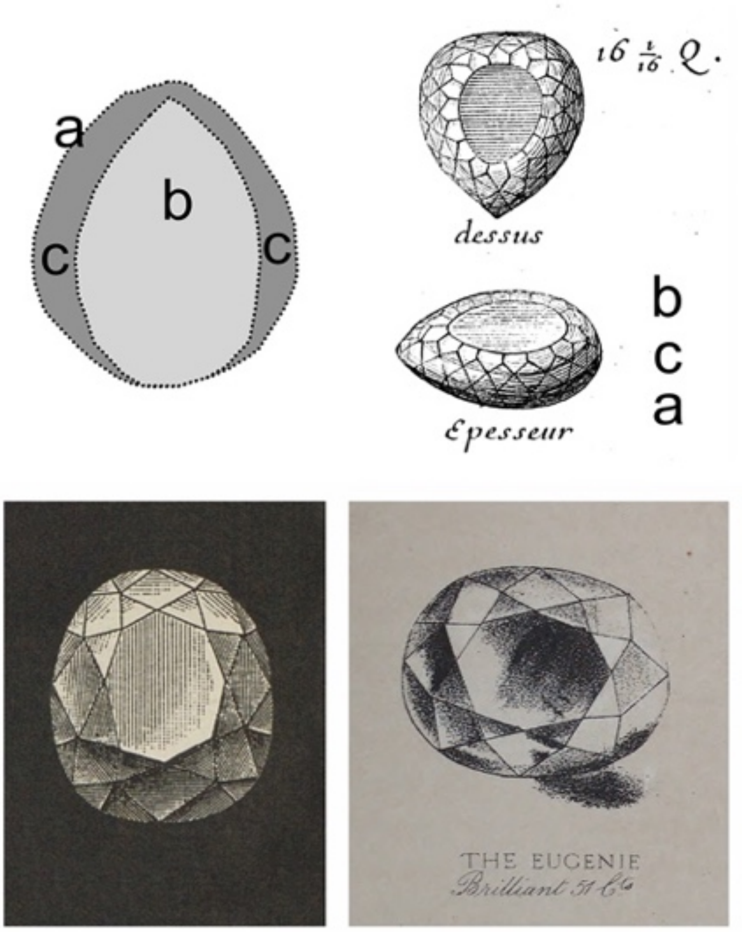

Figure 64 . At top left, the outline of the diamond said to have belonged to Empress Catherine the Great, Potemkin and Empress Eugenie (and probably the Barodas) as it re-appeared in 1998. Its faceting is not clearly distinguishable on the 1998 photographs but it appears to me to be of the *parab* type, delimited by two large facets (a and b) while its section (c) is highly faceted like the ninth diamond illustrated by Tavernier (1676) top right. Below, the supposed drawings of the Eugénie diamond by Barbot (1858) and Emanuel (1867). Note that the weights do not coincide between the modern (heavier) and old versions (54.12 carats vs 51 karats or 52.4 carats). Sources: © François Farges and archive.org.

On the other hand, its reverse seems to consist of a single large facet, probably a large cleavage plane. My reconstruction of this diamond remains approximate despite two superb photographs published by the Galerie Kügel in their 1998 catalogue (I thank Laura Kügel for her great assistance). The gem, measuring approximately 20.5 x 24.2 x 11.3 mm, is said to have been cut in Holland. But I recognise an Indo-Mogol facet of the *parab* type quite close to those brought back by Tavernier in 1668 (Figure 64). This gem is thought to have come from a Brazilian crystal of around one hundred carats extracted around 1760 in Minas Gerais (Reis, 1959), but there is no formal proof. I will

not mention the earlier descriptions of this diamond (Barbot, 1857; Emanuel, 1867; Morel, 1998), which refer instead to an oval brilliant of 51 *karats* (Paris), i.e., 52.4 carats; Figure 64 bottom), which was named “Eugénie” in French or, in English, “Empress Eugénie”. However, the weights do not coincide exactly between the modern version, which is unusually heavier than the historical one (54.12 carats vs. 51 Paris karats, or 52.4 carats).

From Potemkin to Eugenie: so many hypotheses

As for the history of this diamond, known first as Catherine's and then as Potemkin's, the famous British historian specialising in these two figures, Sebag Montefiore (2021), curiously never mentions this jewel in his award-winning books, although diamonds play a relatively prominent role in his works. Therefore, the Russian provenance of this diamond sounds less clear than reported by Morel (1988) and others.

As to the subsequent history of the so-called “Potemkin” diamond(s), Morel (1988) states: “On the death of the Prince, Countess Alexandra Branicky, his favourite niece, inherited his jewellery collection and the diamond then passed to his daughter, Princess Colloredo”. According to the current state of knowledge, it was Princess Catherine Bragration (1783-1857) who is actually entitled to have received the diamond. She is said to have sold it to Napoleon III privately for her engagement to Countess Eugénie de Montijo (1826-1920). Morel (1988, p. 353) doubts this last episode in the absence of formal proof and following the Empress's refusal to receive matrimonial gifts from jewellers (in particular that from the city of Paris). In fact, this author has never found any trace of such a diamond in all the imperial archives and, in particular, in the richly endowed civil list of Napoleon III, who bought so many jewels for the Empress. In fact, since the Middle Ages, it has been common to name a gem after a person who has never owned it. Curiously, this symbolic concept seems to confuse many jewellery chroniclers, who see it as a materialistic possession. One example is the 30.62-carat blue diamond that was named “Eugenie Blue” in 1911 (Balfour, 2008), but which the Empress was never able to wear, and which was subsequently renamed “Blue Heart” (it was donated to the Smithsonian Institution in Washington).

Yet Potemkin is not known to specialists as a collector of large gems. His most famous historian, Sebag Montefiore (2021) does not mention this large diamond in his massive biography, which does not shirk from the field marshal's passion for gems. According to this author (p. 340, who does not specify its source, including language, date or place, while I have not received a reply to my request), Potemkin said to his guests at the end of a meal: "... I adore diamonds and beautiful things, no one in Europe possesses rarer or more refined stones." If true, this is a bold statement, because at the time there were many other wealthy collectors (d'Augny, the Duke of Liechtenstein, etc.) whom "independent" experts such as Louis Dutens (1777) praised for their excellence, although Potemkin is not mentioned. However, "his fury for diamonds" appears documented. From the biography cited above – in which carats are rarely given in contrast to price assessments in roubles – I have recalculated (on the basis of the prices at the time and Tavernier's charter, 1676) a large number of small to medium-sized stones, which is clearly linked to the abundance of gems produced by Brazil at the time, while taking into account the retention of paragons by the Portuguese Crown.

5. Stylistic returns to Portugal

Figure 65 . Tobacco box, one of the few surviving jewellery creations, masterpiece of Jean Ducrollay (1710-1787) and Louis Roucel (-1787), under the supervision of Pierre André Jacqmin (1720-1773). Lisbon, National Palace of Ajuda, inv. 4786. Credits: © Caixa de Tabaco/PNA/Manuel Silveira Ramos/DGPC/ADF (slightly modified).

After France and Russia, the kingdom of Portugal will have its own courtly splendours based on Brazilian diamonds. The National Palace of Ajuda, in Lisbon, still has one of the surviving pieces (inv. 4786) signed by Jacqmin (neither stolen nor dismantled for fashion's sake!): this splendid tobacco tin (Figure 65) is set with Brazilian diamonds, including, set on the lid, a central square-round brilliant, which is wide but not very thick, pale yellow and framed by five palms, each decorated with a large brilliant, which recalls the description of the second insignia of the Golden Fleece for Louis XV, consisting of three palms. This palm motif obviously inspired an as yet unidentified jeweller (and not Adam Gottlieb Pollet as is often written: Rumsey Teixeira, 2022) to make a Golden Fleece insignia for John (*João*), then regent of Portugal and the Algarves since 1799 (Figure 66). The jewel dates from just before 1802, according to a portrait of the prince by Domingos Sequeira (these two works, the jewel and the portrait, are preserved in the National Palace of

Ajuda, inv. 4774 and 4115, respectively). At 27 centimetres, the length of this knightly decoration almost doubles Jacqmin's first insignia, which was already voluminous (16.2 cm), compared with a classic insignia of this order (around ten centimetres). This large size explains why the jewel appears disproportionately large in the portraits, compared with João's small stature (Figure 22 and Figure 25).

Figure 66 . Unknown artist: the insignia of the Golden Fleece insignia of Regent John (João; future Dom João VI) as currently displayed. Lisbon, National Palace of Ajuda, inv. 4774.

6. Then, in Brazil

During his forced exile in Brazil during the Napoleonic Wars, the prince-regent João – who became sovereign under the name of João VI – took a number of jewels with him, including this sumptuous insignia of the Golden Fleece. They were repatriated to Lisbon following his return in 1821 (Rumsey Teixeira, 2022). From the insignia of the Golden Fleece of João VI (Figure 25), to that of his son D. Pedro I (Figure 26) and that of his grandson D. Pedro II (Figure 67), a truly Lusitanian style for this insignia of knighthood, inspired by Jacqmin, was perpetuated through jewellery variants, although only the original from Lisbon seems to have survived (Rumsey Teixeira, 2022). This sublime insignia of the Golden Fleece is still kept at the National Palace of Ajuda (inv. 4774).

On this side of the Atlantic, the court of Emperor D. Pedro II was enriched with new coronation instruments thanks to workshops established in Rio de Janeiro during the period of exile, including that of Carlos Marin, jeweller to the Imperial Crown, who made the second imperial crown (Figure 68). In all, two Brazilian imperial crowns and sceptres have survived, but only the second appears to be richly decorated with brilliants officially from Minas Gerais, as it was made in 1841 before the Bahia deposits were recognised as productive.

Curiously, no great gems entered the Brazilian imperial corpus. An economic crisis then affected Brazil because of the commercial monopoly demanded by the British (via Hope & Co.), who imposed their goods in return, as they had done in India at the expense of the Moguls and then the Maharajahs. Generally speaking, Brazil failed to preserve the major pieces of its mineral heritage, which it systematically resold: none, if not very few, of the monstrous gold nuggets, large crystals and superlative gems from the magnificent pegmatites of Minas Gerais were kept on site during the empire, unlike those extracted during the colonial period and still preserved at Ajuda in Lisbon (Figure 69).

Figure 67 . Pedro Américo (1843-1905): *Fala do trono* ("Speaking from the throne") or Speech by Emperor Peter (*Pedro*) II of 3 May 1872. Note the crown and sword set with diamonds. Petrópolis, Museu Imperial. Credits: © Museu Imperial, source: Wikimedia Commons (public domain).

Figure 68 . Carlos Marin (active 1841-1843), imperial crown (1841) of D. Pedro II. Gold, silver, diamonds (brilliants), pearls, velvet, 31 cm x Ø 43.5 cm (1.995 kg). Petrópolis, Museu Imperial. Credits: © Museu Imperial, source: Wikimedia Commons (public domain).

The same applied to black diamonds and other large carbonados. The Brazilian Ministry of Agriculture took over the administration of the mines. Despite the alarms sounded by the politicians of the Portuguese Ancien Régime about the irreversible dangers of over-developing the colonial mining sector (as explained in Chapter 2), their Brazilian successors seemed to regard subsoil resources as renewable but also secondary to those of the soil, which were seen as a priority (sugar cane but, above all, coffee and beef).

Figure 69 . One of Brazil's gold nuggets, mined during the colonial period. Lisbon, National Palace of Ajuda. Photo (cropped): Jules Verne Times Two (julesvernex2.com/CC-BY-SA-4.0; https:// creativecommons. org/licenses/by-sa/4.0/deed.en). That same museum also exhibits other nuggets as well as a natural Brazilian diamond.

7. And, in return, the *serras* influenced Parisian style

It is impossible to overlook the major influence of Brazilian diamond production on the creation of the necklace falsely known as the "Affaire du collier de la reine" (Affair of the Diamond Necklace ; Morel, 1988, p. 208), as it was involved in the famous scandal that tarnished the reputation of Marie Antoinette of Austria, Queen of France (1755-1793).

Figure 70. « Représentation éxacte du grand collier en brillants des Srs Boëhmer et Bassenge : gravé d'après la grandeur des diamans » (accurate representation of the large diamond necklace of Messrs Boëhmer and Bassenge: engraved according to the size of the diamonds: an evocative engraving of the large diamond necklace of Messrs Boëhmer and Bassenge. An annotated version by the jeweller Bapst (Paris, BnF, Bapst-Falize collection) enabled me to identify the stones, their nature and their total weight. However, another print gives more plausible square-rounded shapes for many of the diamonds.

The Queen's necklace (and its affair)

The jewel was originally commissioned by Louis XV for his favourite mistress, Madame du Barry (Jeanne Bécu, 1743-1793), from the Böhmer family, a firm run by the German jewellers Charles Auguste Böhmer (c.1740-1794) and Paul Bassenge (c.1742-1806), who were established in Paris. The jewel was not completed until after the death of King Louis XV in 1774. It was valued at 'only' 1.6 million livres tournois (ca. 20 millions euros, not including its much greater historical value if the jewel had survived) because it did not contain any stones that were considered exceptional at the time (weighing more than 20 carats).

According to the prints that were supposed to reproduce it (dated around 1786), it consisted of two separate pieces, a choker and a large necklace known as 'en esclavage' (Figure 70). They were set with 645 diamonds, which by my count gives a total diamond weight of 3077.5 carats. The two largest diamonds are a pear and a round brilliant, each weighing 11.5 carats, relatively modest gems for the time. The hundreds of other brilliant-cut diamonds, which are even smaller (averaging around 2.5 carats), suggest that they must have come from Brazil (Minas Gerais). In another print from the same period, the diamonds in the three garlands of the small necklace and those in the large necklace (except for the four tassels and the smallest) are square-rounded, which makes sense for the period as brilliant-cut diamonds were rarely cut into a round shape.

Unsold, the jewel was at the centre of a fraud (1784-1786) orchestrated by Jeanne de Valois-Saint-Rémy, Countess of La Motte (1756-1791), which tarnished the reputation of Queen Marie-Antoinette and ruined the jewellery trade. The swindlers dismantled the largest gems and resold them in London. This scandal has been a recurring theme for journalists and influencers ever since, so I won't go into it again.

As far as I know, the replicas of this necklace kept in two châteaux (Versailles and Breteuil) or in private collections (Baczanger, Marant) are not as accurate as advertised because they do not faithfully reproduce the jewel: the materials (yellowish sapphires in Versailles) or the setting, number, faceting and/or dimensions of the diamonds are wrong (Breteuil, Baczanger). Furthermore, the Versailles version, like many other replicas, is also set with pearls, as the 1786 print shows around a hundred round, unfaceted spheres. However, this interpretation contradicts the handwritten count by the Bapst jewellers on a copy of the historical print (Paris, BnF, Bapst-Falize collection), which mentions diamonds, including where some modern jewellers have mistakenly set pearls.

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count by the Bapst jewellers on a copy of the historical print (Paris, BnF, Bapst-Falize collection), which mentions diamonds, including where some modern jewellers have mistakenly set pearls.

This necklace is described by Morel (1988, p. 205) as a 'genuine harness for a circus horse', decorated with diamonds of the finest quality. I do not know where this second statement comes from, as to my knowledge no precise and reliable description of the quality of the diamonds has come down to us. I am afraid of one of those 'Marie Antoinette effects' that are so prevalent today, which consists of glorifying everything associated with the martyred queen. I would even say, in view of the Brazilian diamonds still on display in the Ajuda Royal Treasury in Lisbon, which represent the best of the production of the time, that the 'Böhmer and Bassenge diamond necklace' must have been composed of a certain number of pale, pink to purple, yellowish to greenish-yellow diamonds, including a number of large square-cut brilliants.

This double jewel is also known as a Berthe necklace in French. A berthe is a piece of women's clothing or jewellery, usually a kind of very wide collar or bodice trim extending over the shoulders, often made of lace or light fabric, sometimes used in jewellery with a light metal matrix (lace) enriched with precious stones. They flourished in the 19th century, particularly during the Second Empire, when neo-Gothic and neoclassical fashions were in vogue around the (last) French Empress Eugénie.

8. Imperial apotheoses, between Brazil and France

In the 19th century, Parisian *haute-joaillerie* continued its prestigious development with the Maisons run by Nitot, Lemonnier, Fester, Kramer, Bapst and others. They rivalled each other in jewellery prowess, setting thousands of small, high-quality brilliants in each of their masterpieces. Many of the gems were recycled from the old collection of jewels of the French Crown, whether imperial or royal, i.e., mainly Indian stones but with a growing proportion of Brazilian stones, especially since the First Empire when French monarchs began buying diamonds again. Indeed, the archives of the various French crowns (Pierrefitte-sur-Seine, Archives nationales, series O^2 to O^5) show that, throughout the 19th century, many new brilliants were supplied by these Maisons: they originated in Brazil, as deposits in South Africa were unknown – if not unheard of – before 1870.

This plethora was greatly enhanced by the use of “black diamond” powder from Bahia which, in the years 1850-1870, was still financially accessible to diamond cutters: not only did its high tenacity speed up polishing to an unprecedented degree, but unlike the diamond powder used in the past, it hardly wore at all. The resulting increase in profitability meant that jewellers could think bigger, denser and faster to achieve new jewellery feats that were financially feasible. Instead of setting hundreds of tiny brilliants to create figures of style such as the insignia of the Golden Fleece, thousands are now used in even more virtuoso creations where the adamantine pavings take on all the shapes required by the goldsmith's design, especially the smallest details. These jewels became the prerogative of women's toilettes, the ostensible adornment of their princely husbands, more “men in black”. Indeed, their husbands refocused on more austere, functional outfits, often inspired by the military (for sovereigns) or the famous “habit noir” (black frock coat, waistcoat and top hat) for the bourgeoisie (more on this below). These new appearances symbolised the new political and economic order.

In particular, the two jewels created in 1855 for the French imperial ~~Empress~~ Crown: the large corsage front bouquet by Théodore Fester (Figure 71) and the large tassel bow by François Kramer (Figure 72). These jewels are

emblematic of this avalanche of relatively small but sumptuous diamonds. In a deliberately old-fashioned neo-rocaille style, the first jewel features a poetically light bouquet of flowers and leaves, composed of 2,637 brilliants (weighing 136 carats) set with 860 rose-cut diamonds (Morel, 1988) and mounted on silver-plated gold. The average weight per brilliant was 0.05 carats, meaning that the diamonds were barely millimetre-sized. The second is a flexible double piece of tassel trimmings, made of silver and 2,634 diamonds (2,438 brilliant-cut and 196 rose-cut). These masterpieces, so unique, were sold in 1887 by a stupid French Third Republic at prices of 31,000 and 42,000 francs respectively (along with many other jewels that were sold without major bids at equally ridiculously low prices).

Figure 71 . Théodore Fester, Paris: Devant-de-corsage (bodice front, stomacher, 1855) for Empress Eugénie. Photo by Michel Berthaud (1887). Unfortunately, this masterpiece from the Paris workshops was sold in 1889 by the French State for a relatively derisory price. It is not known whether this jewel still exists. Source and credit: Paris, BnF/Gallica.

Figure 72 . François Kramer, Paris: centre, large corsage knot (1855; brooch, 1863; 22,2 x 10,5 cm) for Empress Eugénie adorned with 2634 diamonds (2438 brillants and 196 roses) on silver, 22.2 x 10.5 cm. The knot was acquired back for the Louvre Museum in 2003 (inv. OA 12238). The whereabouts of the three others are unknown. Source and credit: Paris, BnF/Gallica.

While the latter was purchased for the Louvre in 2008, we have since hoped that the former has survived. By the same Fester, we should also mention the large corsage brooch with two roses and eleven leaves of Princess Mathilde (1820-1904), adorned with hundreds of small but superb Brazilian diamonds. In another variation of the same style, the Bapsts' breathtaking gooseberry set or the large Kramer belt, whose tassel bow is a virtuoso centrepiece, has fortunately been acquired for the Musée du Louvre (inv. OA 12238). Princess Mathilde's rose brooch, also made in 1855 on the basis of Brazilian diamonds by Fester (and/or Mellerio, depending on the source, including Christie's), has also survived. It continues to pass from hand to hand, as France has not yet seen fit to re-acquire it. The jewel was even renamed it the “Tudor Rose”, even though it has nothing to do with this name.

9. From the *serras* to India

At the beginning of the 19th century, the connection between Brazil and India was still based on clichés about the oriental splendours of the great Mughal emperors of the 17th and 18th centuries. India, once an exporter, became an importer in order to continue nourishing its cultural history, in which diamonds play a crucial role, not only in Indo-Islamic arts, but also in Hinduism and Buddhism, where the *vajra* symbolises the thunderbolt diamond of the god Indra, which, invincible, destroys ignorance. However, many British experts, from Jeffries (1751) to Mawe (1823), struggled to come to terms with the profound paradigm shift between India and Brazil. The arrival of South American gems increased their perplexity: they discredited and even falsified all Latin and South American origins so as to continue to perceive only those from their Indian zone of influence, in other words, from their pre-square.

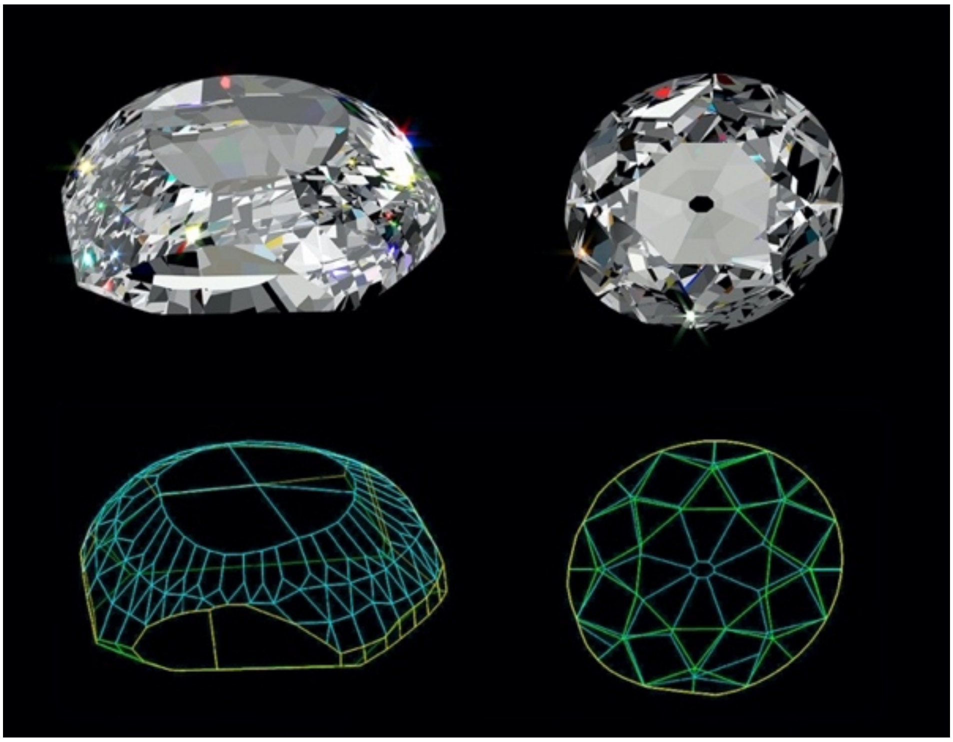


Figure 73 . Photorealistic simulations (top) and meshes (bottom) of Koh-i-Noor before (left, 186 carats) and after its 1852 recutting (right, 105.60 carats). The historical Indo-Mogol faceting (*bullandi*, left) explains the name of this gem: "mountain of light" in Persian. Its recutting into an asymmetrical oval star brilliant (right) was a failure (predictable, above) as well as being a massacre of heritage. Simulations (DiamCalc 4.4) © François Farges.

These commercial shenanigans were amplified in the 19th century when, in Brazil, it was quickly realised that Bahian diamonds had, on average, gemological qualities comparable to the best Indian diamonds, even if their overall size remained inferior (often under 20 carats). Some diamonds were even described as the most beautiful in the world (Teixeira, 2021), even though some, if not many, had been temperature-treated, as we have seen, using the process developed by the French jeweller Charles Barbot (1858) and others. And despite their small size, they were fraudulently sold in Europe as Golconde stones according to Teixera *et al.* (2001). South American diamonds became so highly prized that British experts then tried to trace them back to the mythical Golconde mines to further boost their prices. Indian diamond dealers also reacted (Dickinson, 1965) by suggesting that Brazilian diamonds were merely inferior Indian gems (Jeffries, 1751), no more than "Golconde mine waste" allegedly exported from Goa to Brazil and then to Europe.

As a result, many of the great Brazilian diamonds only passed through Europe. The *Étoile du Sud* was faceted for the Parisian diamantaires Halphen at Costers Diamonds in Amsterdam, where the Dutch diamantaire Levie Benjamin ("Louis") Voorzanger (1815-after 1882) worked. In 1852, Voorzanger refaceted the once magnificent Indian Koh-i-Noor. The Koh-i-Noor, "mountain of light", was then mocked because it became "a mountain of darkness" (Kingsey, 2009), losing half its weight and, above all, its magnificent half-pink mogul corolla facet, or *bullandi*, which gave the diamond all its brilliance and interest (hence its original name, see Figure 73) and its nickname of "monster diamond" (Streeter, 1879). In fact, the brilliant gem was too thin to give a good result, whereas the original Indo-Mogol faceting was a pure masterpiece with sufficient thickness.

The French physicist Babinet (1855), a specialist in mineral optics, pointed out the scandal of such a refaceting and was alarmed when the same Voorzanger went on to cut the *Étoile du Sud* for the Parisian diamond merchant Joseph (Frédéric) Halphen (see the box dedicated to the cutting of this diamond). In fact, Voorzanger made a rectangular-round cushion of the most classic and unoriginal kind, like the Koh-i-Noor of 1852, even though this time the Brazilian diamond had the required depth of 19 mm. Babinet (1855) rightly

prefers a Sancy-type double rose facet, which would have produced a much larger, more brilliant and original gem. However, the number of facets would have had to be at least doubled, not to mention the greater difficulty of faceting a double rose, which requires much more subtle lapidary skills than those required for a single brilliant. Profit was more important than art.

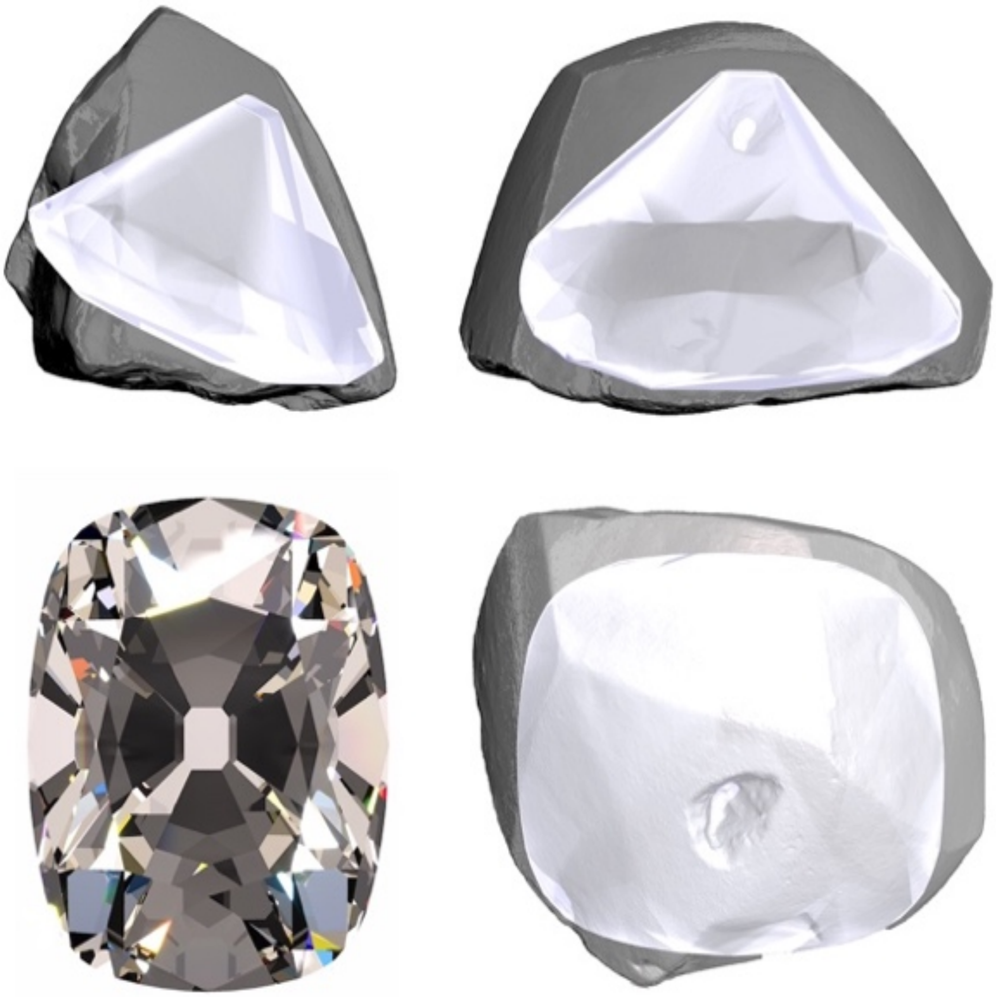


Figure 74 . Diagram of the probable recut of the South Star seen from three angles (side, front and top) based on the surface laser scan of the MNHN cast inv. 55.105 (grey volume) compared with the reconstructed model of the gem (purplish volume; data from Smith and Bosshart (2002). There are few possibilities for inserting the present gem into the original crystal. Bottom right, photorealistic simulation of the gem using DiamCalc: the colour is approximate because the absorption spectrum published by Smith and Bosshart gives a very absorbent gem that is browner than pink compared with the original (their spectrum has been adjusted in absorbance to obtain the correct hue). Drawings, calculations and simulations by the author.

Faceting the *Étoile du Sud*

In their study of this gem, Smith and Bosshart (2002) state that the faceting of this Brazilian diamond was the first to receive “an international acclaim”. But, like many English authors, many keep ignoring the studies of French-speaking experts such as Babinet (1855, p. 813). Even before the recutting, Babinet pitied the planned cushion faceting of the *Étoile du Sud* at Costers in Amsterdam (translated): “They are thinking of reducing it to about 127 carats. What a shame! Allow me to come back to the Sancy cut [author's note: a double rose], and to point out that this cut, which always leaves room for subsequent brilliant cuts, lends itself marvellously to preliminary tests, and that it would be prudent, for such considerable values, to sacrifice only at the last resort the immense quantity of substance that ordinary cutting removes from stones in the shape of Indian or Brazilian diamonds. I have seen the model of the shape that this diamond should take when cut in Amsterdam. Like the Koh-i-Noor in its present form, it will be an overspread stone, i.e., too thin for its width when viewed from the front. Babinet is also right about the Koh-i-Noor, which was “massacred” when it was recut in 1852 into an oval brilliant that was too thin, greyish and dull (Figure 73). Jacobs and Chatrian (1880) conclude: “The wise advice was given too late, or rather routine once again resisted science” (Figure 74).

To me, these authors are right about the double rose faceting of the Sancy diamond, which is much more brilliant and original than an oval cushion, of which there were already many clones. Curiously, this distortion of reality persists: the Costers website (www.royalcoster.com) currently presents an approximate history of the Etoile du Sud (and a terribly inaccurate replica of the English Dresden, even though they faceted the original a century earlier). In short, the so-called "international acclaim" continues to be regarded by French-speaking experts as just another massacre for maximum profit (same for the English Dresden; see later). So, I join Babinet, Jacobs and Chatrian in saying – once again – “What a pity!”

Figure 75 . Engravings of the English Dresden diamond: a terribly conventional pear (or drop) shape imposed on a fabulously extraordinary adamantine material. Note also its shallowness (above), a major flaw where Voorzanger repeated (or more likely, was forced to repeat) the same errors as for the Koh-i-Noor. Credit: Escaud (1914); source: archive.org.

Another Brazilian diamond of excellence, the English Dresden (Figure 75; note that the French did not rename it as *Dresde anglais* but keep tribute to its first British owner as facetted, as do the Portuguese, the German, the Italian, the Russians etc..) was faceted directly without science having been able to keep any lasting traces of it, alas! The same Levie Voorzanger then faceted the English Dresden which, as its name does not clearly indicate, is linked to Edward H. Dresden, an English trader from London who had previously bought it in Rio de Janeiro. This other Brazilian diamond, originally weighing 119.5 carats and noted for its transparency and lack of colour, was found four years after the *Étoile du Sud*, in 1857, in the same rio Bagagem deposit that has since been renamed the Estrela do Sul locality. Dresden suggested that it had been found in the itacolumite from which the gem mass was cleaved, the remaining part having since disappeared, alas! (Streeter, 1879). The Dutchman

faceted it into a 76.5-carat drop (a pear shape flattened at its base) just as banal as those he supplied for the Koh-i-Noor and the *Étoile du Sud*. Worse still, Barbot's drawing of the English Dresden (Figure 75) shows a gem that, like the Koh-i-Noor, is not thick enough: my simulations of this gem show it to be around 11 mm thick, which is indeed too thin and similar to the two large diamonds of around 18-19 carats once supplied by the Nitot jewellers (especially their son François-Régnault, 1779-1853) to Emperor Napoleon I.

Figure 76 . Top left: Malhār Rāo Gaekwad, eleventh maharaja of Baroda adorned with the large (though very poorly reproduced) five-row necklace of some fifty huge diamonds. Note the scarf of fine pearls descending from his left shoulder and the many large emerald drops. To his right is a photograph (by Bourne & Shepherd, dated November 1875) of Sayajirao Gaekwad III, a grand-nephew who became the twelfth maharaja that year. He wears the other famous three-row necklace with the *Étoile du Sud* and the English Dresden (see the engraving of this jewel below). Sources: The Graphic (27 February 1875), www.oldindianphotos.in and The Illustrated London News (1 January 1876). Credits: The Glenn Christodoulou Collection, Wikimedia Commons (public domain).

There was a period of difficulty when no customers rushed to buy the two great Brazilian diamonds because of their price and despite strong publicity. Pedro II, Napoleon III and Eugenie came to mind, but there were still no buyers for the two gems: they were too expensive or too ostentatious, not original and not in keeping with the taste of the time, which preferred large,

elegant pavings of smaller diamonds, more suited to adapt to the artistic gouache and technical goldsmithing. Meanwhile, the maharajahs took up the sumptuous torch from the fallen Mughal emperors. These new rulers of an India under British protectorate bought a large number of new diamonds cut into Western-style brilliants. The most emblematic from this point of view remains Malhār Rāo Gaekwad (circa 1831-1882), eleventh maharaja of the principality of Baroda (Figure 76), located in the present-day state of Gujarat in India (Baroda was renamed Vadodara when the principality acceded to the Indian union in 1949). Despite a short reign between 1870 and 1875 (he was deposed because of his many personal misdemeanours), he made countless purchases of large Brazilian diamonds that could not be bought by the emperors of Europe or Brazil. Around 1872, after the decisive Prussian victory at Sedan and the exile of the French imperial couple to England, Malhār Rāo is said to have acquired the Potemkin/Eugenie diamond (Balfour, 2008; who cites no source). He subsequently bought the *Étoile du Sud* and then the English Dresden.

As early as 1875, the two large gems were mounted in a three-row necklace, the Baroda (Figure 77). The English Dresden appears as imposing as the *Étoile du Sud* (both gems measure approximately 35 x 29 mm) although the former weighs much less than the latter (76.5 compared with 128.48 carats): this effect is due to the differences in thickness: 11 (estimated, low) compared with 19 mm (much better). Below these two monsters, a diamond drop hangs. As the various old photographs of this jewel are of poor quality or taken from too far away, I am not entirely sure that I can recognise the Potemkine/Eugénie diamond despite its characteristic asymmetrical drop shape and *parab* faceting (I remain cautious as Morel, 1988, made a mistake in identifying the diamonds in this jewel). The dimensions of this drop on the old photographs, approximately 24 x 20 mm (based on the known dimensions of the *Étoile du Sud*), may indeed correspond to a diamond of 52-54 carats if we consider a thickness of approximately 11-12 mm, which remains entirely plausible as it is identical to that of the English Dresden, but of a squat shape whereas the latter is extended and flattened.

Figure 77 . The Baroda necklace with three rows of brilliants. Source: Illustrated London News 1876, 1 January 1876, p. 24 (archive.org, reworked by FF).

The necklace was modified in the 20th century for the famous Sita Devi. Later, the drop diamond – possibly the Potemkin – and the *Étoile du Sud* were resold, as was probably the English Dresden according to gossips.

It was then that Brazil provided a new avalanche of large diamonds (50-700 carats), including the Vargas (726.6 carats) which, like many others, was found around Coromandel (Minas Gerais), not far from the Rio Bagagem where the *Étoile du Sud* had been found a century earlier. This new boom is mainly due to the mechanisation of mining, which has speeded up the processing of large quantities of sediment.

From Scrap to Science

1. First, *ferrajão*

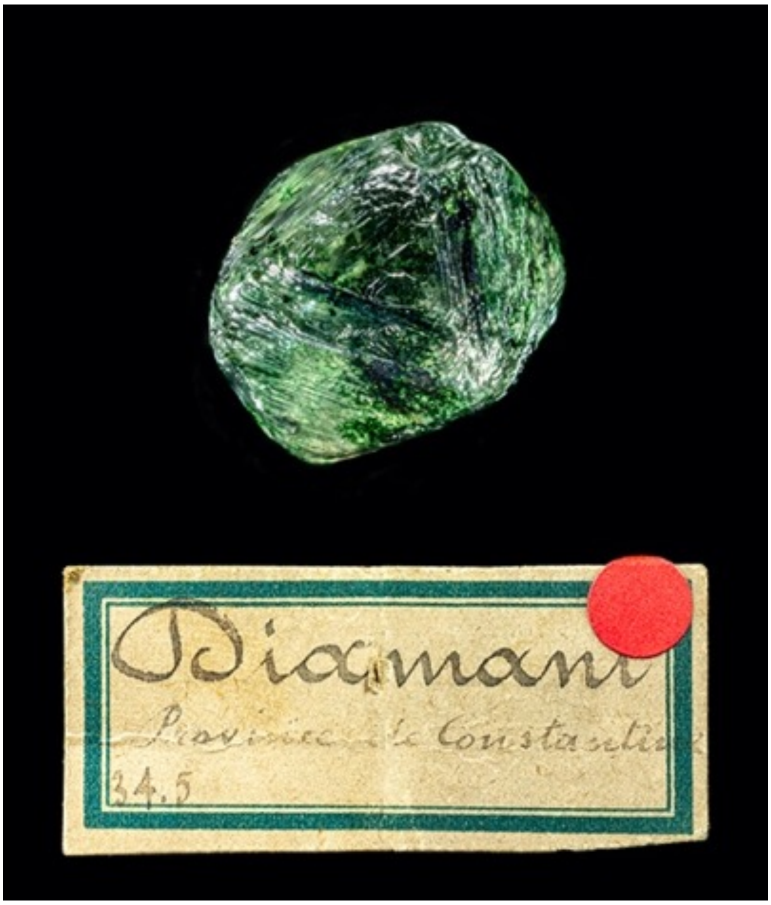


Figure 78 . The first diamond (0.46 carat) found in Africa: an octahedron (1833) from the Constantine province (Algeria) and its original historical label (on a scale of 1/5 opposite the crystal, which measures 4 x 3.5 x 3.5 mm). Paris, MNHN, mineralogy, inv. 34.5. Photo: © François Farges/MNHN.

In the 1845s, the first local miners sold only gem diamonds, most of which were colourless to yellow to green, rejecting the black ones: they named the latter first *ferrajão* (scrap) and then *carbonado* or *carbonato* (carbonised) because of their resemblance to burnt coal. They were then considered uninteresting, including by many European diamantaires (see Herold and Rines, 2011; Herold, 2013; Shigley, 2020, although these writings contain errors corrected here). Rather than discarding them with the waste rock, some miners use them as mortar (Ganem, 2001). This was noted by curious naturalists passing by. Historical diamond deposits were in the process of being depleted (India) or

were less well known to Westerners (Borneo: Sun *et al.*, 2005) or had just been discovered in Siberia (Kaminsky *et al.*, 1978) or in Africa, including Algeria in 1833 (Godard *et al.*, 2014) with the magnificent green octahedron preserved at MNHN inv. 34.5; Figure 78), much earlier than those found in the rich deposits of the Transvaal.

Figure 79 . Black diamond impactor in the anvil of a Vickers hardness testing instrument. Note that the black diamond tip used (a long time ago) is barely damaged, unlike its metal anvil which is rusty. Photo (2012) : © R. Tanaka/Wikimedia Commons (Creative Commons Attribution 3.0 Unported license).

At the time, few naturalists were able to observe diamonds in their bedrock, except in Brazil, to understand their geology, which remained incomprehensible. But the geological mechanisms remained unclear, a fact deplored by the English reverend and geologist Charles Grenfell Nicollay (1815-1897) who, after scouring the Chapada Diamantina for diamonds in 1865, contributed no real stone to the edifice but nevertheless predicted an imminent solution to this enigma (Downes and Bevan, 2012). However, all the historical deposits (India, Brazil, the first in Africa) are all exploited in gravel: are they secondary deposits resulting from the alteration of ancient rocks? At the time, geological interest in diamonds was booming. Travellers brought these unusual "black diamonds" from Brazil to a number of European

collectors and museums. These mortars of a new kind were even “harder” than gem diamonds: why could one diamond, at the top of Mohs' scale of mineral hardness, be surpassed by another? (by the way, this Mohs scale is empirical, because since Mohs, scientists have developed a more rigorous (quantitative) scale such as the Vickers scale, which measures the indentation produced by a diamond point, often black (Figure 79). However, descriptive mineralogists have not adopted this method.

This unprecedented resistance to polishing, already mentioned in the introduction to Chapter I, intrigued prospectors working for Parisian diamond merchants, including two men named François Fertin (for gem diamonds; Ganem, 2001) and “A. Chabaribere” (for carbonados; Pereira, 1910). The latter – whom some current authors mistakenly also call Chibaribert – is François-Alban Chabaribère (1820-1880), a gem trader from the Charentes region of France (say, roughly, the region growing the Cognac brandy to be more explicit) who emigrated to Brazil via Montevideo in 1836 at the age of 16 and a half, where he seems to have joined his father Marcelin, who died in “Cattité” (Caetité?) in 1847 according to genealogy.net. François-Alban died having been naturalised in Brazil under the first name of “Francisco Albano” (his line later became known as Chabaribery). Above all, he is known as the first (if not one of the first) to notice black diamonds. Brown-black diamonds were at one time (19th century) referred to as “Savoyard diamonds” (I never caught the logic, except that the first carbonados arrived in France from the Netherlands via Switzerland), according to the daily *La Belgique Judiciaire* of the 31st of May 1863 (XXI, 44, p. 703).

2. France in Lençóis, from myths to legends

After the Anglo-Portuguese treaty expired in 1825, major Parisian houses set up in Salvador de Bahia and Rio de Janeiro to buy crystals. From then on, Paris replaced London as the largest market for Brazilian diamonds. The French-speaking world was particularly active at this time, with Francophile landowners and merchants commissioned by Paris to buy gem-quality diamonds. Some even claim that a French (vice-)consulate was open in Lençóis, which current guidebooks locate at 63 Praça (square) de Horácio de Matos in a listed building (by IPHAN, the *Instituto do Patrimônio Histórico e Artístico Nacional*), although Haggerty (2014) locates it in another colonial-style building further down on another thoroughfare in the historic city centre.

Figure 80 . Left: view of one of the main square in Lençóis in the 1950s, now known as Horácio de Matos (see also Figure 34). The tall building on the left is the presumed French vice-consulate according to popular oral tradition and local guides although no French archive (Archives diplomatiques, La Courneuve) confirms its existence. Curiously, Haggerty (2014; Figure 2d) places this mythical building at 845 avenue Rui Barbosa (in the street that starts on the right of the left photograph). On the right, a recent view of this tall building, recently renovated and classified as a Brazilian heritage site (IPHAN). Photos: © Roy R. Funch (based on a photograph from the former collection of the late garimpeiro Mestre Oswaldo, with permission) and ©Tatiana Azeviche (Setur Turismo Bahia; Creative Commons Attribution-Share Alike 2.0 Generic license; slighly cropped).

However, Teixeira (2021) states that there is no proof of the existence of this consulate. In fact, the Diplomatic Archives (in La Courneuve) and the trade almanacs of the period make no mention of any diplomatic

representation in Lençóis other than in Salvador (which closed in 1947). This author believes that it was a commercial representation of a French import Maison. Guanaes (2001) states that (translated into French) "in the documents of the State of Bahia, there are official references to a trading house owned by officials of the French government" but without specifying any sources nor providing more explicit details.

On the basis of the account given by the vice-consul Castelnau (1850), I am inclined to think that the various French consuls in Bahia were on "fact-finding missions" – between the curious and the covetous – which could have led to the opening of an official delegation. For example, Castelnau (1850) recounts the expertise of consul (Jean-François Maxime) Raybaud, who seems to have been very knowledgeable about the diamond trade in 1846. The former's account is highly critical of his predecessor's behaviour, but very well argued: it betrays that he is just as interested. We could then postulate, without any other proof than these sources, that certain French agents went on mission to Lençóis to buy natural diamonds of excellent quality from local sellers who were very aware of this mark of prestige, especially as, from the consul's point of view, these crystals, which were so small in relation to their value, took up very little space in a pocket on the way back to the mother country (...). What is more, the consuls only stayed in their position for a few six months at most, just long enough for a few profitable courtesy visits (...) to Chapada Diamantina. Back in France, the stones were highly prized by Parisian jewellers who, as soon as the Second Empire was established (1852), received numerous orders for jewellery where the traceability of the stones, and even less so of monetary exchanges, was in its infancy. Finally, the credentials of a French diplomat clearly reassured the Parisian jewellers of the time...

In the Chapada Diamantina, Teixeira (2021) confirms that high society plays Pleyel pianos and the ladies dress in the latest Parisian fashions (of course...) sold at the Magnolia shop (located right next door to the so-called vice-consulate) at fashionable (Parisian) salons where guests dress in their finest diamonds to listen to the music and literature of the day. Or those social evenings – the *saraus dançantes* – where gold and crystal goblets filled with (French) champagne from the best brands (of course...) clink as Moraes (1973)

mythologises, as if their transfer of Champagne to the equatorial Chapada were a mere routine formality for a relatively sensitive product. In the meantime, the backyards of these great houses, these neighbourhoods of slaves and former prisoners, were developing their own paradigms, which would become their own cultural reference point a century later.

3. Science on the move

Be that as it may, naturalists and prospector-dealers then brought these strange, compact, blackish stones to the attention of Parisian scientists, and their prices began to rise in just a few years from 0.5 to 2 francs per carat (old Paris *karat* from before 1906 = 1.023 metric carat, a unit that was not adopted worldwide until 1907 at the General Conference on Weights and Measures in Paris).

Figure 81 . The first mineralogist at the MNHN to work on enriching the MNHN's collections with diamonds and carbonados in the 19th century: Armand Dufrénoy. Paris, Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. PO 385.

In 1848, the MNHN, via Professor Armand Dufrénoy (1856, II, p. 96 ; Figure 81), in charge of the collections, acquired one of the very first *monsters*, weighing 65.76 grams (321.4 *karats*; 328.8 carats; Figure 82). This specimen was sold by a certain Hoffmann, a German mineral dealer who was not the French writer mentioned above, whom he named “carbonite”. It was bought for 840 francs (2.6 francs per carat, a price that doubled again in 1856 to 5

francs...). That's barely 8,000 euros today, but it is still a significant sum for the institution, given that the French government continues to systematically underfund its museum, unlike its art museums.

Louis-Édouard Rivot (1820-1869), chief mining engineer, professor of docimasie (mining engineering at the time) and director of the laboratory and testing office at the Paris' *École nationale (supérieure) des mines* (today Mines Paris – PSL), studied this “monster” and a few other small ones. This researcher observed that they were porous and composed of graphite particles agglomerated with diamond microcrystals, hence their colour (Rivot, 1849).

Figure 82 . The large black diamond from the MNHN (Lençóis, Bahia), 328.8 carats, found in 1848 (40 x 32 x 36 mm). The first large carbonado ever studied in the history of science and not subsequently destroyed by miners, diamantaires or scientists (see the trace of a probable historical sampling on Figure 91). It is an exceptional Brazilian specimen of world class, both in historical and scientific terms, yet still largely unknown or underappreciated. Paris, MNHN, inv. 49.255. Photo: © François Farges/MNHN.

Rivot called them "carbonic diamonds", which he believed reflected the presence of both forms of carbon in the agglomerate. The author added that (translated) "*the edges of the large fragment are broken by long rubbing, but it is not rounded like rolled pebbles. It is a dull, slightly brownish black. Examined with a magnifying glass, it appears to be riddled with small cavities separating very small irregular lamellae, which are slightly translucent and iridescent in the sunlight. The brown colour is very evenly distributed throughout the sample. On one side, the cavities are arranged in a straight line, giving it a fibrous appearance like obsidian. It cuts glass easily and scratches quartz and topaz. Its densitý, taken in distilled water at 12 degrees centigrade, is 3.012.*" Further on, the author reports the results of physico-chemical tests, including their almost perfect combustion in oxygen, which leaves only clayey micro-residues. To discuss this last experiment, he cites one of the theories on the formation of this substance (given translated here only for its epistemological interest): "*this result does not prove, it is true, the igneous origin of these diamonds, but it renders unlikely the opinion put forward by M. Liebig, that diamonds come from the eremarausia of organic vegetable matter.*" (Author's note: eremacausis or slow combustion, a term coined by the German chemist Justus von Liebig, 1873-1873, which did not survive him).

Soon after, Dufrénoy (1856) renamed this new "variety" as "compact and amorphous diamond" (as we shall see, this is not exactly a variety of diamond, but a subtype of diamantite rock that is not at all amorphous and compct but porous and tenacious). The announcement of the discovery of a new form of "diamond" clearly caused a stir in Paris, where diamond merchants were quick to make the most of its incredible resistance to grinding. Its powder makes it possible to polish gem diamonds faster and more accurately, which means greater faceting precision and, above all, saves time and money. An avalanche of diamonds, especially the smaller ones, was about to sweep through Paris, Amsterdam or London because of their unparalleled brilliance and regularity. As one can also imagine, the news spread very quickly to Bahia, where garimpeiros began digging up the old excavations in search of these once-rejected *ferrajãos*.

4. Des Cloizeaux

Figure 83 . The second great mineralogist who worked to enrich the MNHN's collections with diamonds and carbonados in the 19th century: Alfred Des Cloizeaux. Sources: Paris, Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. PO 385 and 531.

The second major series of mineralogical studies on these diamonds was carried out by Alfred (Le Grand) Des Cloizeaux (1817-1897) at the MNHN (Figure 83). Like Dufrénoy, he studied various batches of small specimens, one of which was bought for 4 francs per carat in 1847 (Des Cloizeaux, 1855), the 2024 equivalent of around €11: this second specimen was one of the first carbonados mined in the Chapada Diamantina (Figure 84). The price remains affordable, but these samples are barely centimetric. In the years that followed, Des Cloizeaux was able to observe a large number of specimens in Parisian diamond shops. The then named “Black diamonds” were now widely used for faceting gem diamonds, and diamond merchants were sharing out this important Bahian industry. The French capital, along with London and Amsterdam, became the world's leading importer of carbonados.

Figure 84 . Three carbonados studied by Alfred Des Cloizeaux from Bahia, probably around Lençóis: (a) in the centre, a microscopic gold flake (25 µm long; details in insert); (b) the two carbonados from the coast inv. 107.823. Each measures approximately 10 mm in diameter and weighs 2.0 to 2.5 carats. They have been enlarged (x 2) opposite their labels. Paris, MNHN, mineralogy, inv. 107.822 and 107.823. Photos: © François Farges/MNHN.

Only the writings of mineralogists such as Des Cloizeaux allow us to reconstruct the geodiversity of these specimens, the overwhelming majority of which have disappeared because they were not moulded before being ground into chunks or powder. He awkwardly called them "carbonate" (!) by Frenchifying the Brazilian Portuguese *carbonate* and then wrote (translated): "*Its structure is sometimes crystalline with octahedral forms, sometimes saccharoid or compact and amorphous, sometimes slightly porous, sometimes completely spongy and in this last case presenting a tissue filled with numerous oval vacuoles perfectly discernible to the naked eye. The surface of the pieces is generally black and shiny, but their fracture is dull and offers different shades of brownish grey, ash grey, greenish grey, etc. I have had the opportunity to examine large quantities of carbonado brought to Paris in recent years; I have encountered some very rare cubes with blunt edges and small spheres bristling with crystalline points. I also observed several pieces penetrated by small grains of gold, which would seem to indicate that gold may have been injected into the pores of the diamond*" (Des Cloizeaux, 1874). Alas, only a few of these carbonados have survived: one is actually associated with native gold (Figure 84).

More precisely, it was a micro-flake stuck in a rough crack in the

carbonado during the detrital phase of deposition. A second, extremely rare carbonado ballas from Lençóis, mined in the 1850s, shows "crystalline points" (Figure 43).

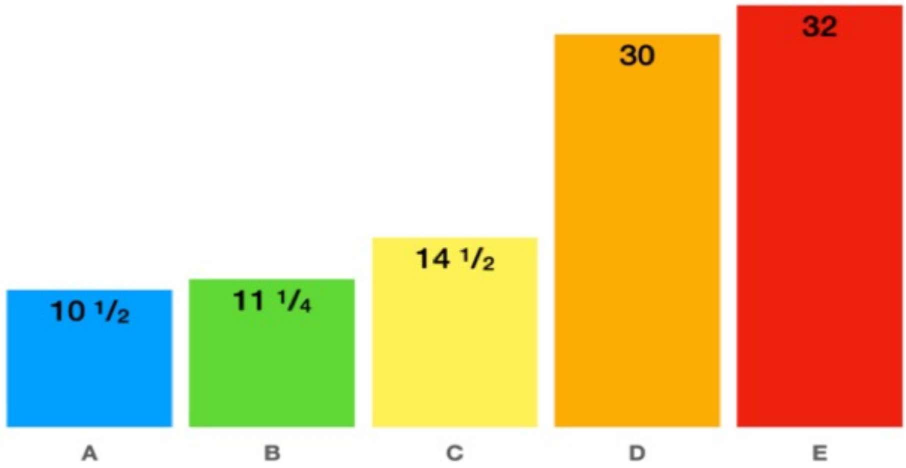


Figure 85 . Evolution of the "refractive power" of various gems according to Barbot (1857): A: quartz; B: ordinary glass; C: sapphire; D: gem diamond and E: black diamond. In detail, it is difficult, with current knowledge, to follow Barbot's reasoning in relation to Newton (1704).

Some mineralogists also sought to quantify the optical properties of black diamonds: following Haüy (1796, p. 182), the jeweller Charles Barbot (-1862) listed the refractive power of gems according to a protocol established by Newton (1704, II, 3, prop. X, pp. 70-77) as the ratio between the quantity of refraction at the limiting angle and the density of a transparent body (based on this, Newton predicted the combustible nature of diamonds; later, Haüy rediscovered this prediction and encouraged Lavoisier to verify it with his diamond combustion experiment; but modern science has shown that the correlation between refractive power and combustion did not exist other than to have allowed Newton a happy intuition with no effective scientific correlation). For Barbot (1858, p. 193), this value, which has since been abandoned, gives an indication of a gem's brilliance: glass and sapphire are measured at 11.25 and 14.5, respectively, while a colourless diamond – 30 – is surpassed only by the "black diamond", which peaks at 32 (Figure 85). Given that these measurements are determined on polished surfaces, it is likely that the black diamond used by Barbot for his measurement is indeed monocrystalline and not a carbonado. We must therefore assume that the

numerous graphitic and metallic inclusions, so abundant in many black diamonds, contribute to increasing the refractive power of the nominally pure diamond. The fact remains that black diamonds have set records for toughness (polycrystalline) and brilliance (monocrystalline), two properties that remain crucial to the gem concept.

Thus, scientific interest in Brazilian diamonds was growing at a time when science and technology were establishing themselves as an economic requirement for industrial development. All the more so as the Portuguese crown no longer held a monopoly on diamonds and the Brazilian state did not sequester them in the eyes of naturalists, as Lisbon had done in the 18th century. On the other hand, the Brazilian empire was seeking to develop its nascent post-colonial economy: the export of its agricultural and mineral wealth was seen as an enrichment (although the opposite was true in the long term). For example, the *Étoile du Sud* diamond (translated as Star of the South in English) was acquired and shipped to Paris by the Halphen brothers, who were highly reputed diamond merchants at the time. They enabled scientists to study the crystal and made casts to preserve a trace of it, which Joseph Halphen donated to various museums, including the Muséum national d'histoire naturelle in Paris. This exceptional gift, so rare today, included two replicas, one in plaster – more technically accurate – and the second in glass, which simulated the original crystal as closely as possible using the techniques of the time, probably for more museological purposes (Figure 37).

Various sketches were drawn up and published (Figure 86) by Dufrénoy (1856). Quite recently, Smith and Bosshart (2002) included these original drawings in their study of this gem. They argue that Dufrénoy's drawings are not as realistic as that of the Englishman Emanuel (1867; Figure 87). However, examination of the two casts of the mineral kept at the MNHN shows that the English drawing is highly fanciful in many places (errors of proportion, perspective, location and nature of details, etc.). But these approximations are effectively invisible to the untrained eye, because they are overshadowed by heavy gradations and other supposedly artistic depth effects (see the box on this page, which puts this other Anglo-Saxon superiority complex into perspective). Be that as it may, Brazil was becoming an increasingly fascinating field for

mineralogy, a science that at the time was much more Parisian than Anglo-Saxon.

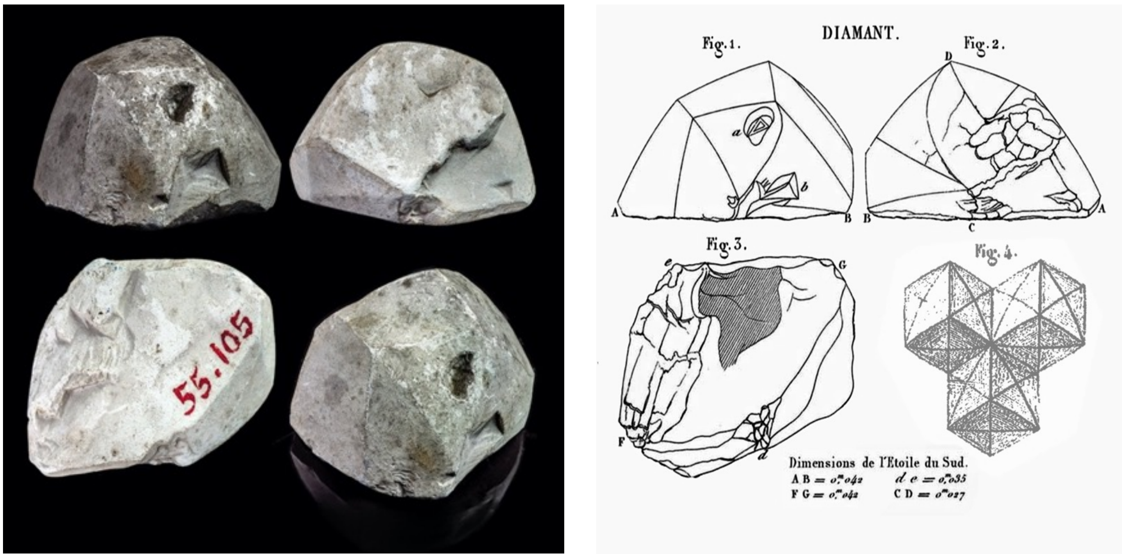


Figure 86 . Drawings by Dufrénoy (1856, vol. V, plate 225) of the natural diamond (the drawing “Fig. 4” has been greyed out as it corresponds to another subject); next to it, photographed equivalents of the plaster replica accompanied by a more panoramic view (lower right). Source: Paris, Muséum national d'histoire naturelle, mineralogy collection (library) and donation by Joseph Frédéric Halphen, 1855, 43 x 31 x 27 mm. Paris, MNHN, mineralogy, inv. 55.105. Photos: © François Farges/MNHN.

Figure 87 . Emanuel's engraving (1867) of the South Star crystal, judged realistic by Smith and Bosshart (2001), compared with the same view of the 1855 cast. The comparison does not really argue in favour of a realistic engraving, which is instead highly approximate. Source: Paris, Muséum national d'histoire naturelle, mineralogy collection (library) and donation by Joseph Frédéric Halphen, 1855, 43 x 31 x 27 mm. Paris, MNHN, mineralogy, inv. 55.105. Photo: © François Farges/MNHN.

5. Embezzlement

In the Chapada Diamantina, there were unfortunately two disasters. Between 1857 and 1871, a severe drought affected the mines. The remaining miners were kept busy, particularly between 1859 and 1862, when the main bridge spanning the Rio Lençóis was built to take advantage of its drying up. Without water, it is easy to imagine that many of the miners not only found themselves idle, but were also victims of famine, as the drought also affected food crops. The Chapada Diamantina was emptied of its inhabitants. As if that was not enough, epidemics ravaged those who remained (Teixeria, 2021). Not to mention those who went off to fight in the war between Paraguay and Brazil (1864-1870), which was joined in 1865 by its allies in the Triple Alliance (Argentina and Uruguay). Added to this was the Franco-Prussian war: after 1871, Parisian diamond dealers no longer had the sumptuous orders from the deposed and exiled Empress Eugénie. The fall in prices caused the region to desert as quickly as it had been engulfed by the rush 25 years earlier (Martins, 2013). As if these misfortunes were not enough, rich deposits in South Africa were discovered and developed on an industrial scale from the 1870s onwards. Especially as the first deposits, around Orange, were also sedimentary or formed chimneys in a semi-arid context: here, gravel and *yellow ground* – the name given to weathered (oxidized) kimberlite – were easily extracted. This is a further blow to the already affected mines in Chapada Diamantina (and Minas Gerais), especially as those still active continue to be mined in the same traditional way.

In order to survive, a number of garimpeiros converted from 1880 to the heat treatment of diamonds using a flux (borax and/or potassium salts melted at around 500°C) to discolour those that were not colourless enough, following a method originally patented by Barbot (1858). Edwin W. Streeter (1879, p. 69) dismissed the French receipe by force-imposing his British truth: “It seems scarcely possible that this can be accurate”. To get a better idea of Streeter's bad faith, read Jacobs and Chatrian (1884, p. 171). These diamond traders from Antwerp even generalised the extent of the heat treatment undergone by Bahia diamonds, which were all said to be burnt (translated): “No doubt these

facts, verified in Paris on parts of diamonds from Brazil, could be disputed. The reason for this is that diamonds from the province of Bahia are burnt, meaning that merchants from the Chapada mines, before sending them to Europe, subject their diamonds to an operation to strip them of a sort of gangue that covers them and makes them appear coloured." They add that the recipe is that of molten potassium nitrate into which the diamonds are introduced to discolour them before they are consumed, as demonstrated by "experiments at the Conservatoire des Arts et Métiers" (the CNAM in Paris). Molten potassium nitrate therefore removes the outer part of the crystal, its "*écorce*" (bark) in the words of Tavernier (1676, II, p. 307) rather than a "sort of gangue" (we now know that the edge of a number of diamond crystals is often greened by radiation damage, while the interior is unaffected by this phenomenon). So it was not only the French who developed this method of dissolving the rim of colored crystals into molten salts, but also other Antwerp-based diamantaires such as Tobias Demoulin (Figure 88) and most of the garimpeiros in the Chapada Diamantina until today.

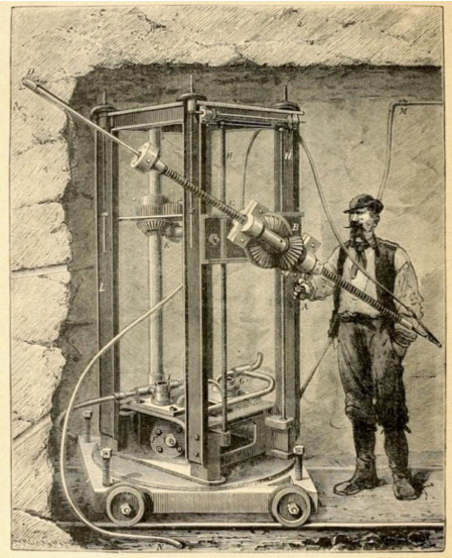
Figure 88 . Historic boxes (slightly before 1879) inscribed "Matière diamantifère" (diamantiferous matter): in fact, various residues of heat treatment associated with diamond polishing (almost certainly Brazilian), including borax and other melting salts (fragment in the middle, taken from the box on the right) and other melting agents used to " discolour " them according to the process of Charles Barbot (1858). Workshop of the Antwerp (Belgium) diamond merchant Tobias Dumoulin (1820-?), a close associate of the Voorzangers. Paris, MNHN, mineralogy, inv. 79.26 and 79.29. Photo: © François Farges/MNHN.

Shortly afterwards, in 1882, some people migrated to the new Salobro (Canaveiras) diamond mining area. At a time when the Cape mines were producing diamonds in unprecedented quantities, this deposit was discovered by a local man, a former diamond miner. Although smaller and unique compared to the South African deposits, Salobro's production is qualitatively superior due to “the incomparable beauty of the crystals found there” (Jacobs and Chatrian, 1884, p. 155, translated). These authors add (translated too): “It is two days from Canavieiras, in the Salobro forest, which covers alluvial ground, at a depth of barely 50 centimetres, in a reddish *cascalho*, that we find these stones that all the world's markets are fighting over.” And that's saying something! In fact, Gorceix (1882) states that in 1880, Brazil produced 80,000 carats (16 kilograms) while the Cape mines exported 2 million carats (25 times more), but of such inferior quality that the Brazilian diamonds were sold as historic stones from the Golkonda mines in India (which were almost exhausted or poorly productive at the time). However, the Salobro rush was short-lived and the deposit was soon almost depleted. These Brazilian gem diamonds, despite their gemological qualities, were no longer as popular with dealers, who turned to those from South Africa, which were yellower overall but more abundant than those from the Chapada Diamantina (Jacobs and Chatrian, 1884, p. 28). This difference in quality and quantity enabled traders to ensure a stable supply for their customers, especially as the price of diamonds continued to fall due to the overproduction of yellowish stones emblematic of the early days of South African production. Such was the case with the first diamond found in South Africa, the Eureka: discovered in 1867 as an isolated crystalline mass, it originally weighed 21.25 carats. It was cut into an oval brilliant of 10.73 carats and then generously donated by De Beers to the Kimberley Mine Museum in South Africa, where it is still on display.

6. The rush for the "black diamond": the Leschot system

Brazil looked for the most "endemic" commercial substitute possible: carbonados were the key to this revival since the 1870's (Beaujeu-Garnier, 1966). They found a new use beyond the diamond workshops, this time for industrial purposes. As part of the second industrial revolution (1870-1914), the railways and mining and oil exploration increased dramatically, and with them the need for tunnels, mining galeries, oil drilling and other uses of boreholes.

This industrial revolution was made possible - at the same time as the development of the various iterations of "ite" (gelignite, ballistite and cordite) that were to give rise to the more famous dynamite of a certain Alfred Nobel (1833-1896) - by a second innovation that had just taken place in the field of drilling: the Leschot system.



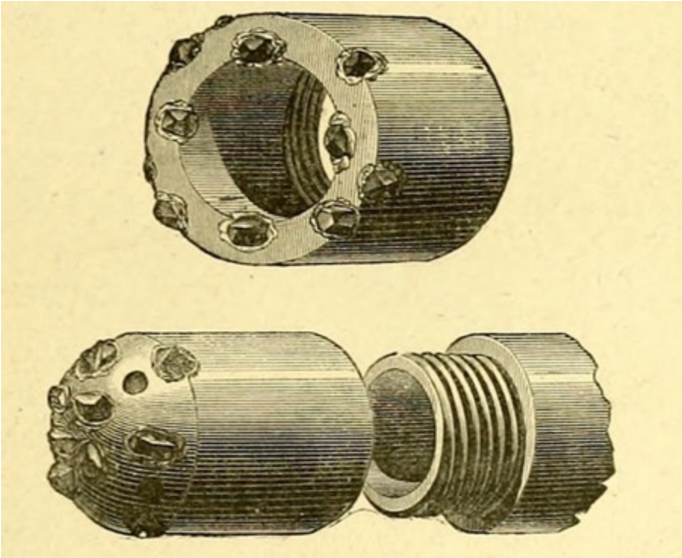


Figure 89 . Leschot's perforating machine, with detail of the crown "set" with carbonados (drill bit). Illustrations taken from Figuier (1884). Source: archive.org.

As early as 1860, the Swiss Georges-Auguste Leschot (1800-1884) of the Geneva firm Vacheron Constantin and his third son Rodolphe Adolphe (1837-1875), an engineer from the École Centrale des Arts et Manufactures in Paris where he had settled, developed their rotary drill for hard rocks (Figure 89).

The invention, known as a crown auger (later to become a core drill with a drill bit), consisted of burins set with carbonado of a few carats each and driven hydraulically in rotation. They gave a demonstration in Paris in 1862 and filed a patent for this technology, which they improved in 1869.

This system involved breaking the carbonados with a Formholt machine into similar fragments of a few carats (Figure 90). The use of this machine made it possible to reduce fragmentation losses from around 30% to a few percent for a quality carbonado. These images of the fragmentation of the 3rd largest carbonado then known in 1902, discovered in 1901 and weighing 750.5 carats, show that its interior was originally much lighter than its exterior, but that the new fractures quite quickly became darker. It is a pity that this phenomenon has escaped scientific scrutiny.

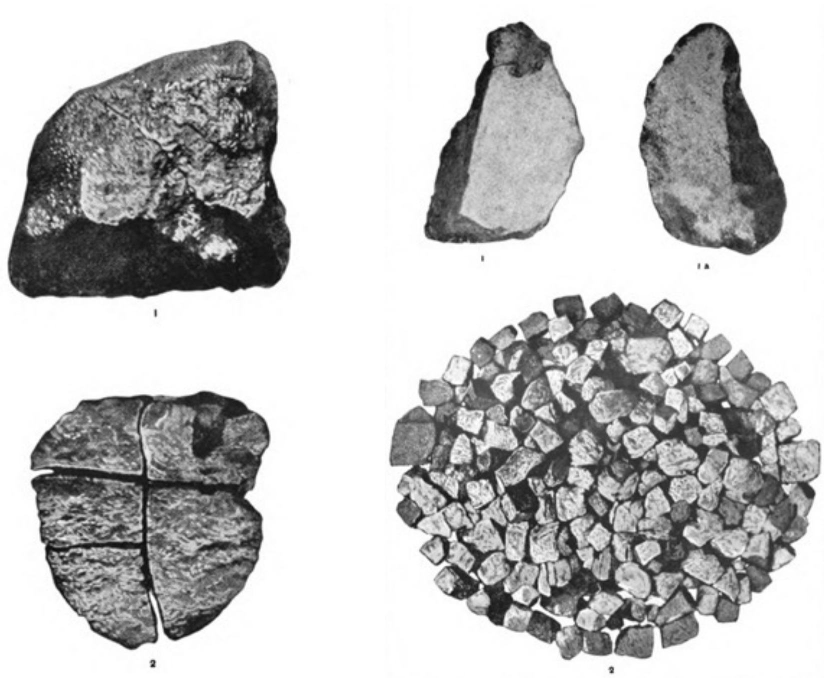


Figure 90 . The three stages of fragmentation (Germany, 1902) of the then third-largest carbonado (left), weighing 750,5 *karats*, with a view to implanting the nearly cuboidal fragments (right) in a drill bit. Source: Kunz (1904) and reproduced in Baszanger (1906) and (left picture only) in Kraus (1911, p. 11, Fig. 5) who mistakenly announced it as the 1895 carbonado later named Sergio. Source: archive.org.

The MNHN's large Bahian carbonado, weighing 328.8 carats, has a very dark brown cortex over its entire surface. It appears to have been stripped of material in only one place, perhaps as an old sample for chemical analysis

(Figure 91). This lack of material makes it possible to see the inside of the specimen, which is light grey and reminiscent of the images of the previous split carbonado (Figure 90). Furthermore, the colour does not seem to darken with time, as it has not changed for at least fifteen years. However, the extreme rarity of this type of carbonado sample means that it is no longer possible to analyse the reasons for these colour differences.

Figure 91 . Detail of the surface of the 328.8-carat carbonado (1848) from Bahia, showing its light grey interior contrasting with its dark brown bark. On the lower base of the specimen, we can see a deep black Judean bitumen primer that was used to position the black diamond on its historical base (probably made of black-painted wood), which has not been found.

Almost all of these "carbons" were thus irreversibly sacrificed on the altar of economic progress, notwithstanding the scientific treasures they contained and with no concern for the programmed depletion of the mines for future generations. It was understood that the Ancients had exhausted many deposits, but progress was bound to compensate for this shortfall by the inexorable discovery of other deposits. Once the gold of the Old World, yesterday the black diamond, tomorrow oil.

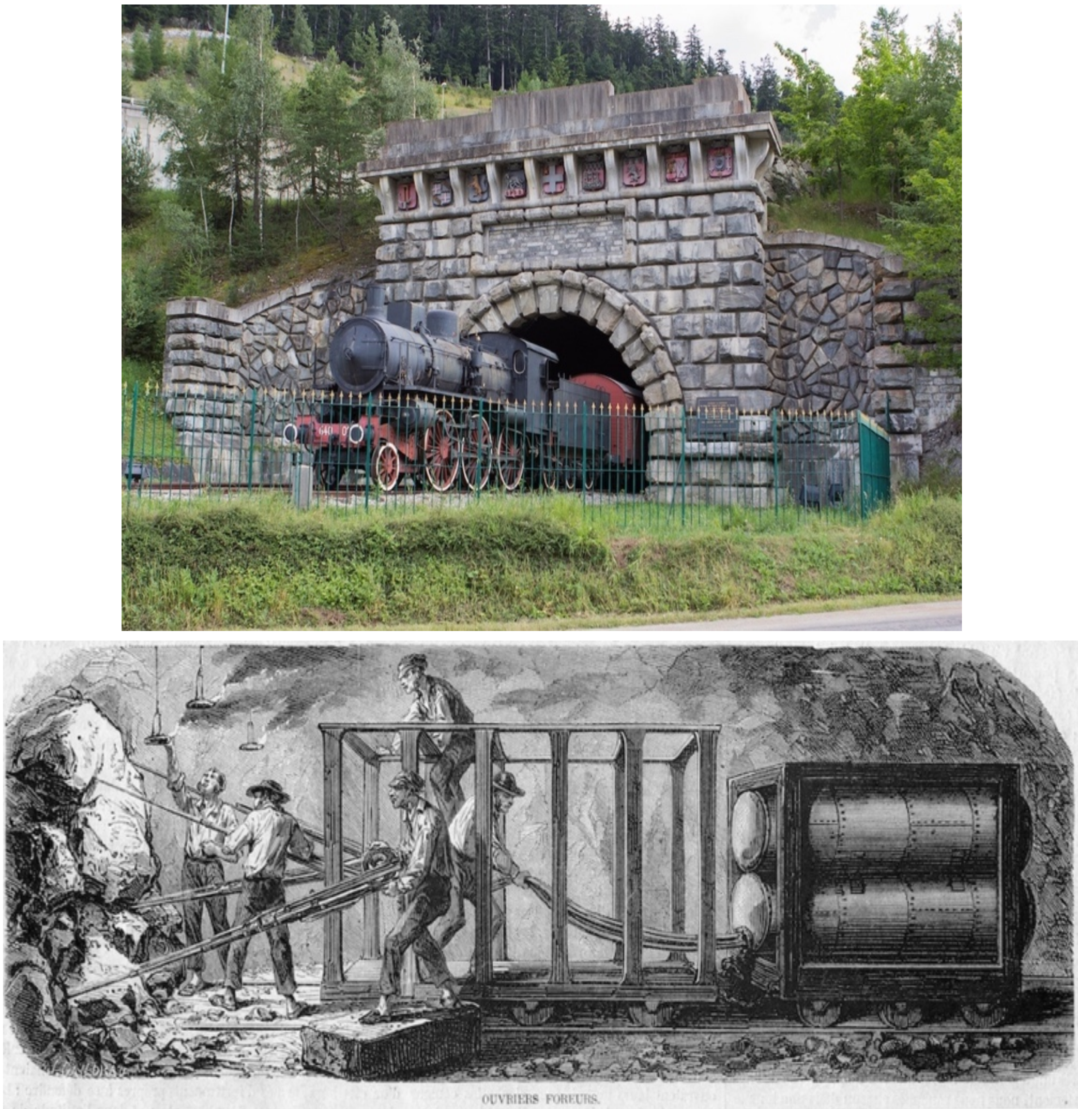


Figure 92 . Above: Former entrance to the Mont-Cenis (now Fréjus) railway tunnel, on the French side at Modane (Savoie, France). Photo: © Poudou99/Wikimedia Commons (Creative Commons Attribution-Share Alike 3.0 Unported license). Below: Jules Gaildrau (1816-1898): Drill workers (drilling the Mont-Cenis tunnel with compressed air perforators). L'Illustration, February 1862, p. 108 (scanned by Havang(nl)/Wikimedia Commons.

To pierce the rock with this perforator, the rod rotates at a speed of 250 to 300 revolutions per minute. The debris is removed by a stream of water injected under pressure into the shaft, which is then hollowed out. Jacobs and Chatrian (1884, p. 420) add (translated): In the Rheinfelden borehole in Switzerland, a depth of 475 metres was reached in sixty days. With the old system, it would have taken two or three years, i.e., an expense fifteen times greater. This is how this marvellous mineral, when deprived of the advantage

of being attractive, still has the merit of being useful. They gained international renown and constantly perfected their "Leschot system", which was first used to drill blast holes for the Mont-Cenis transalpine tunnel (opened in 1871; Figure 92) and then in the Gotthard tunnel (1881).

7. From the Alps to oil magnates

Figure 93 . Top: Édouard Riou (1833-1900): "La tribune des souverains" (Musée national du château de Compiègne) at the inauguration of the Suez Canal according to (bottom) Évremond de Bérard (1824-1881).

These "carbons" were also used to dig the Suez Canal, which was inaugurated with great fanfare on the 17th of November 1869 (Figure 93) to (translated) "the greatest glory for France and the greatest profit for England" (Edmond About, *Le Fellah*, 1869). The French entrepreneur Ferdinand de Lesseps (1805-1894) was the great architect of this pharaonic project, in which

Empress Eugénie was at the height of her glory. Another French glory where carbonados worked wonders despite the technical difficulties was the Panama Canal (1914).

These diamonds were even used extensively in the digging of the London Underground – there is even talk of the Paris Underground (Pereira, 1901) although I have not found confirmation of this – and the construction of Manhattan's skyscrapers and bridges (Herold and Rines, 2011). Not forgetting oil drilling, where the crown of the core drill became today's drill bit, and mining galleries, where extraction reached new heights of economic profitability. So, the rise of the United States, the conquest of the West by rail with Leland Stanford and others, the oil windfall from the East to the South and the advent of hyper-rich tycoons (who went on to overfund universities, science centres and museums) have some of their deepest roots in the Chapada Diamantina.

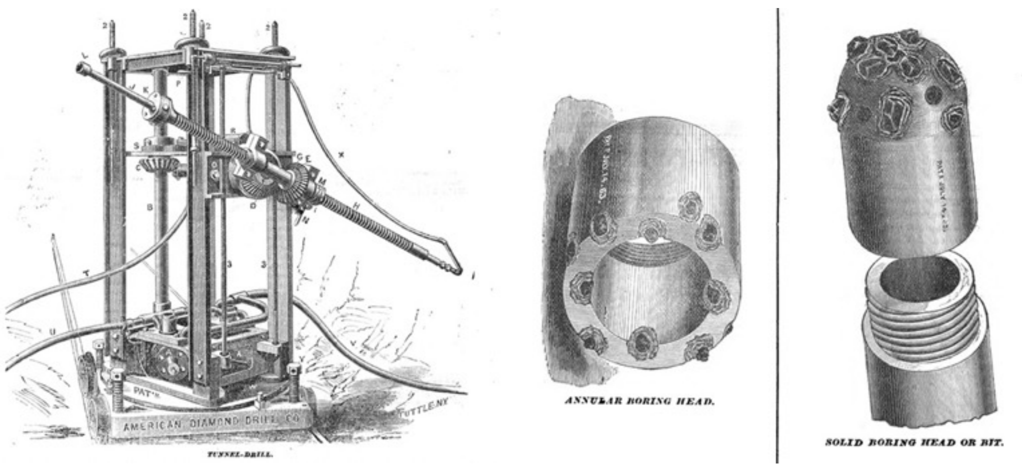


Figure 94 . The Leschot system adapted by the American Diamond Drill Co. Note the similarities with Figure 89.

Only a few years after Leschot filed his patent, the American Diamond Drill Co. of New York adopted Leschot's invention. The Engineering and Mining Journal (XII, 21, 4th series, 21 Novembrer 1871, pp. 1-2) states: “The American Diamond Drill Company, while retaining the Leschot principle, nave made many improvements in the machery of the drills” then “There are now in operation at the Fair of the American Institute two diamond drills (manufactured in this country under the Leschot patents), which seem likely to

revolutionize the business of rock drilling". Indeed, the Diamond Drill Co. design is said to be "Pat.'d" (Patented) and appears to be an exact copy of the Leschot design (Figure 94).

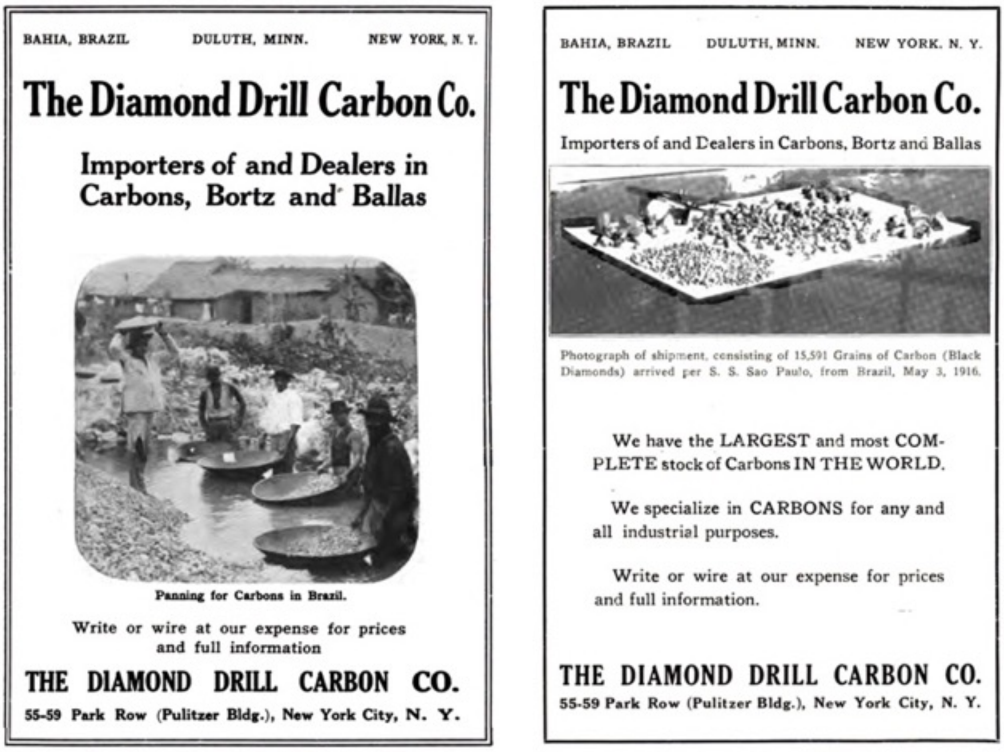


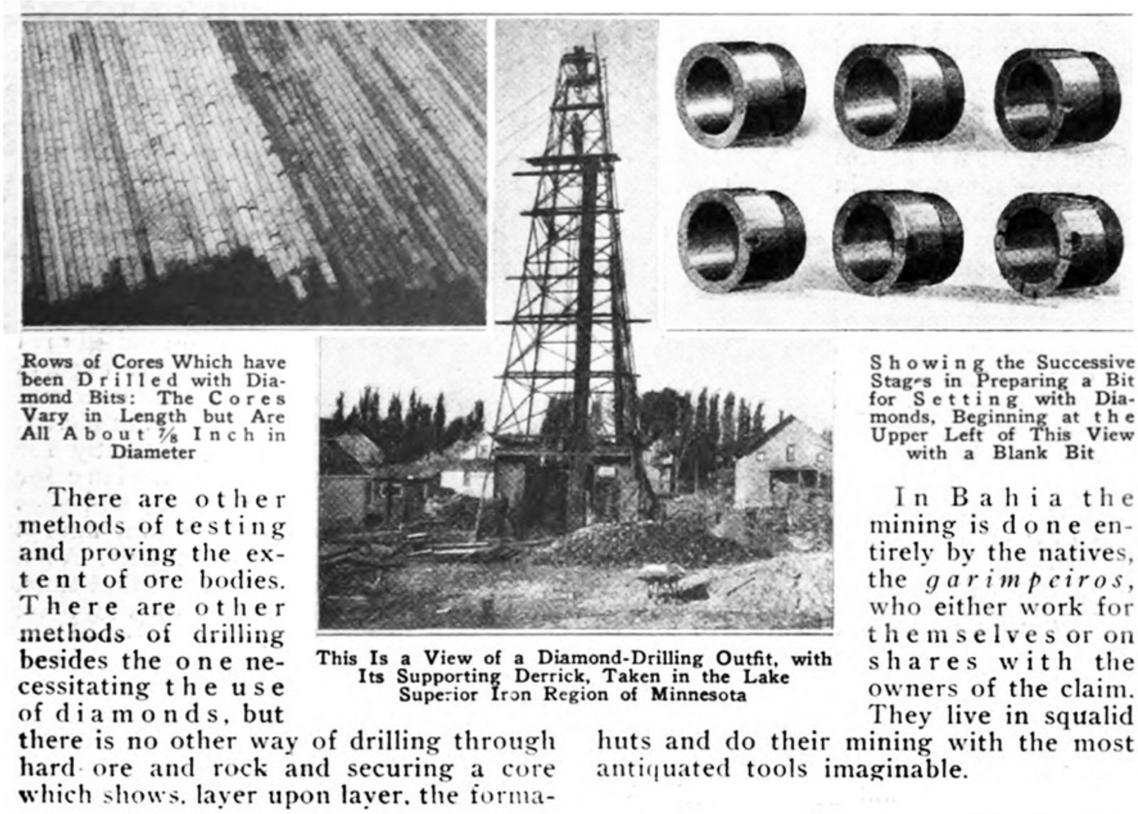
Figure 95 . Two advertisements for the American Drill Carbon Co. of New York during the First World War (Weed, 1916, p. 22 ; 1918, p. XXVI).

In the meantime, Leschot died poor and almost unknown. Because English and especially American companies appropriated Leschot's rights without paying royalties (Figure 95 and Figure 96). The Belgians Jacobs and Chatrian (1884, p. 420) confirmed: "As always, it was English or American companies that would later come to use this process in France, where they would claim this fine discovery as their own as soon as the inventor and his system were forgotten, and they would not have to wait long" (see Figure 95 and Figure 96).

Alongside the tunnels and other transoceanic canals, oil drilling and la current hydrocarbon civilization could never have developed so rapidly without the black diamonds of the drill bits (Figure 97) creating other American super fortunes, including the Rockefellers.

Figure 96 . Advertisements, including from Victor Bishop & Co., for carbon core drills with an illustrated clone of the Leschot system. Source : The Engineering and Mining Journal, LVIII, 26 (29 december 1894), p. 43.

On the Brazilian side, no Leschot core drills (or its clones) arrive at Lavras Diamantinas, where black diamonds are still mined by hand; the rare imported machines rust on the spot (Furniss, 1906). This author even explains that a Bahian miner would drill 2 or 3 holes a day, whereas the core drill would do it in a few minutes. North American chroniclers (Rothwell, 1898) noted the low productivity of the garimperios, who found only three or four carbonados in six months, compared to the exploding demand and the over-cautious investments of the Europeans, who were in great demand and content to buy the stones from the capangueiros and resell them in Europe.



Rows of Cores Which have been Drilled with Diamond Bits: The Cores Vary in Length but Are All About 7/8 Inch in Diameter

This Is a View of a Diamond-Drilling Outfit, with Its Supporting Derrick, Taken in the Lake Superior Iron Region of Minnesota

Showing the Successive Stages in Preparing a Bit for Setting with Diamonds, Beginning at the Upper Left of This View with a Blank Bit

There are other methods of testing and proving the extent of ore bodies. There are other methods of drilling besides the one necessitating the use of diamonds, but there is no other way of drilling through hard ore and rock and securing a core which shows, layer upon layer, the forma-

In Bahia the mining is done entirely by the natives, the *garimpeiros*, who either work for themselves or on shares with the owners of the claim. They live in squalid huts and do their mining with the most antiquated tools imaginable.

Figure 97. Extract from *Popular Mechanics* (May 1923, p. 713) illustrating the use of black diamond drill bits (top right) in oil drilling (middle) and the resulting drill cores (top left) (all based on the extraction of the poor garimpeiros of Bahia; read the right section). Source : HathiTrust/archive.org.

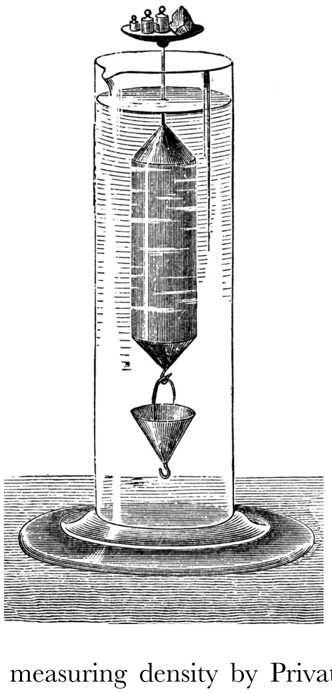


Figure 98 . Nicholson *hydrometer* for measuring density by Privat Deschanel (1868, p. 109). Source: archive.org.

The value of carbonado thus increased a hundredfold from the 1870s onwards. Garimpeiros quickly realised that carbonado the most tenacious had a density of around 3 (instead of 3,52 for monocrystalline diamond, black or not). To determine its density and therefore its selling price, they even used a hydrometer (Haggerty, 2014), or an aereometre by (William) Nicholson (1753-1815; Figure 98) which, however, provides only an approximate and inconvenient measurement. And this was only the beginning: thirty years later, Leonardos (1937) confirmed that the best-quality carbonado could be sold for almost as much as its best-quality gem equivalent, up to US$500 in 1920 for a five-carat stone (Herold, 2013). This works out at around €8,000 today, taking only inflation into account, or even €50,000 based on the price of gold.

A welcome respite for the Chapada Diamantina, which is being revitalised now that the water and the miners have returned. During this new period of prosperity – between 1880 and 1930 – the old spoils were re-exploited in the search for any new black diamonds, as the drillers were mainly after small stones of a few carats. The monsters, or masterpieces if you prefer, were to emerge from this new windfall.

THE FABULOUS 1895 DISCOVERY

1. At the *Brejo da Lama*

In July 1895, the new diamond rush (this time black) was in full swing between Lençóis and Mucugê, where the Gomes de Azevedo family still owned the "Second Company". It was administered by another of Virginia's sons, Josè Venâncio, and a certain Sérgio Borges de Carvalho was prospecting for diamonds there. He is described as "old, aged 50 and responsible for his family" (Pereira, 1895). This author also states that he was then "*em extrema infusação*" (under extreme curse). He is clearly not, as stated here, in the "*oficio da garimpagem*" (miner's trade), as he is an independent *faiscadore*, which is a disparagement from the garimpeiros' point of view. He is probably a freedman (or his descendants) of an eponymous master, as the children of slaves automatically become such at birth and often take their master's surname.

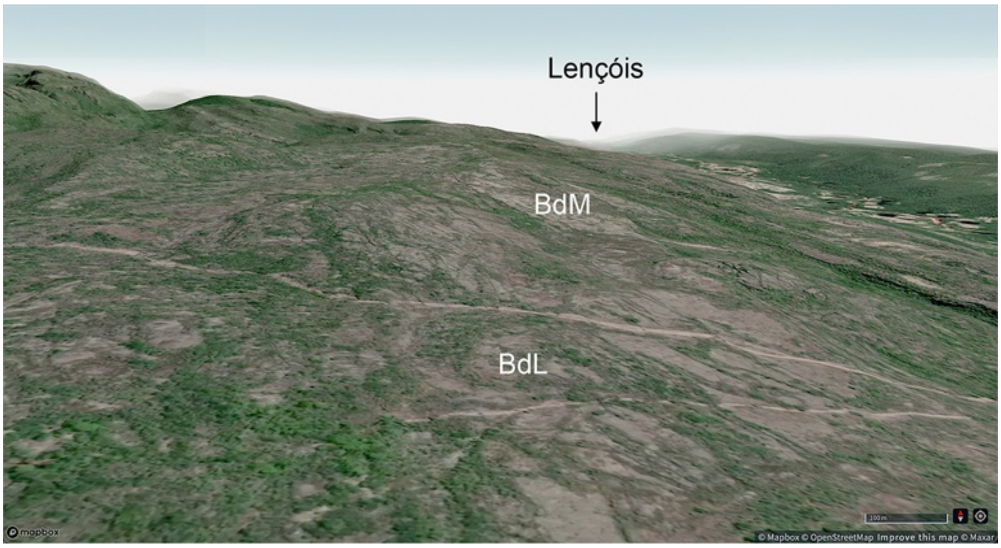


Figure 99 . Current aerial view northwards of the mountains between the Bicas and Roncador valleys, showing the Brejo da Lama (BdL, Funch, 2002) in the foreground and the Beijo da Maderna (BdM) further north in the background. Note the network of diaclases marked by vegetation and crossed by streams running down the slopes towards the São José, which flows southwards below, with its valley clogged with mining sediments to the right. Lençóis lies in a basin, hidden by the relief of this northern part of the Chapada Diamantina. In the 19th century, these mountains were teeming with miners, forming a vast mining site covered with various buildings and piles of gravel. 3D cartography: © Macrostrat (Creative Commons Attribution 4.0 International license) with additions © mapbox, OpenStreetMap and Maxar.

According to Ganem (2001), Sérgio worked hard on this mountain concession, which had already been mined (Figure 99Figure 100). At a time when the price of gem diamonds had collapsed due to the industrial exploitation of rich African deposits, these *faiscadores* were looking mainly for the carbonados rejected in the early days of the rush (1844-1870; Nolasco, 2002).

Figure 100 . Stream and dam at Beijo da Baderna, in the immediate vicinity (northwards) of Brejo da Lama. Photo: © Roy R. Funch (with permission).

A deliciously spicy but forgotten anecdote sums up this context that prevailed at the time. Originally published in the *Correio de Noticias* of the Bahia on 20 July 1895, this chronicle was reprinted on the 25th in its equivalent in Minas Gerais (Lavr*as Diamantinas. Minas Gerais: Orgam Otticial dos Poderes o Estado-MG*, 219, p. 6) by a journalist who goes by "G.A.P. " and who explains to us: "*I'm referring to a legend of a huge carbonate found in the "Roncador" mountains in a fire called "Samuel", also from the 2nd company, and whose carbonate was used to bruise peppers in the garimpo of Mr Tite José Vieira and others. Tite José Vieira and other partners, and when they had to move, they threw the stone away because they thought it was worthless; but in 1880, when the carbonate was at a high price, many people went in search of this wealth*

and we even remember that Major Theotono Gomes de Azevedo wasted some time and spent a lot of money to see if he could find it, which he couldn't."

As for Sergio, the *faiscadore,* was in stark contrast to the *leões*, the "lions of the crowbar" who frantically tore into the restive *cascalho*. On the 15th of July 1895, neither *Senhor dos Passos* nor *Santa Bárbara* cared about this garimpeiro morality but rather from its "extreme infusion": they sent Sérgio the spark of the millennium. He discovered the most imposing carbonado of the time on the ground, and one that would remain so, even today: a specimen weighing 181 *oitavas* or 3,167 ½ *quilates* (Pereira, 1895; we will come back to these weights below). What if Tite José Vieira's "chilli-crushing carbonado", as described above, was not the original discovery of the monster carbonado later named Sergio? And if a curiosity dealer had passed by during Tite José Vieira's time, could the carbonado have been preserved?

Babinski (1897) asserts that large carbonados are often found in the open air (and not in the mud as has been written). In fact, erosion easily brings them into relief, rather like mushroom rocks or fairy chimneys, where a large compact rock is eroded and brought into relief, as if placed on a temporary substratum that is finer, more composite and therefore looser, as in the Brejo da Lama (Figure 31, Figure 99 and Figure 100). This implies that this carbonado may have been found around the 1850s and then discarded in some waste dump. I fantasize that it could have been sampled by a curiosity dealer, bought as such and still kept in a museum...

Pereira (1895) reports that, since its discovery, the diamond has lost weight: it now weighs only 3,073 carats (probably due to its porous structure, which may have been moistened when it was extracted from fluvial sands, to which I will return later). In 1897, a certain Alexandre Pereira found another carbonado in the same deposit (Meira de Andrade, 1999), weighing 33 *oitavas* or 591.5 carats (118.3g, of which nothing remains). Meira de Andrade (1999, pp. 112 ff) presents an impressive list of finds of the largest carbonados, based on export declarations and rare photographs of locally preserved multi-centimetre specimens. However, this document does not include discoveries made prior to 1850, when large carbonados were only "curiosities" and were exported unchecked (such as the one in the MNHN

dating from before 1849; Figure 82), or those that had been lost or stolen in the meantime. Some authors even report the discovery of a *ferrajão* weighing more than 2 kilograms (10,000 carats!), said to have been thrown away by slaves in the early days of the rush (Souza Silva, 2017), unless it was the 2,000-carat ferrajão (instead of a gram) cited by other authors (Ganem, 2001).

2. Big carbonados, small fortunes

To this day, *Sérgio's carbonato* remains the largest "diamond" officially discovered. No, it is not the Cullinan, discovered ten years later in 1905 in South Africa, that is the most imposing of all, as is often reported by over-hasty journalists who only see the gem diamonds of celebrities. The resulting stones, the Cullinans I to X, which adorned the British Crown, made him immensely famous as much for their mineral splendour as for their frivolous glamour. However, the South African has borrowed the limelight from the Brazilian, despite its lighter weight, probably as a result of a well-known British soft power... There is also the symbolism of the colour black in the West during the 20th century in Occident, not as much appreciated as the colourless, often confused – even today – with white by these same journalists, who are always in too much of a hurry (like quartz or calcite, diamonds can be hyaline, colourless, or milky, white).

Serre (1913) explains that Sérgio Borges de Carvalho received one hundred *conto de réis* for this diamond, the equivalent of one hundred kilograms of gold, or 160,000 French francs at the time (€1.23 million in 2024). He describes a "very rough miner" who "squandered this money in one year". His article seems to be tinged with condescension, clichés if not worse. For example, Serre is surprised that, twenty years earlier, a poor miner named Domingos de Azevedo, did not try to sell the diamond in Paris to make a better fortune! Serre also forgets to mention that the miner had to make concessions to the mine owner (25%) as well as to the State for the concession granted, then to the local potentates, levying official taxes and unofficial dimes, as well as to other mafiosi and their barbaric gangs, not to mention thefts and unpaid advance payments (a classic of this milieu). All this in a region that is still fairly remote, with no major banking infrastructure and teeming with shameless swindlers who had to swoop down on the too-lucky Sérgio, who already had to pay off his debts, in particular to the local grocer who had inevitably gambled – patiently – on the return of his loans (Furniss, 1906). Serre's account is contradicted by Ganem (2001), who explains, not without romanticizing or giving his sources (alas!), that (translated) "Sérgio Borges de Carvalho left

the *Lavras Diamantinas* to return to his native region of (the river) São Francisco, further west, where he used his savings to set up farming and stockbreeding" (note the inverted commas and the conditional tense in the absence of references). In this case, he may have "squandered" his fortune in a single year, as Serre aversively writes: it seems, however, that Sérgio was more realistically talking about investments.

In short, other local miners have testified that they received only a quarter – or even 10% – of the face value of the diamonds they mined (Ganem, 2001). Herold and Rines (2011) add that Brazilians, miners, dealers, the state, politicians etc., have cornered more than 65% of the ultimate commercial value of these stones; the final dealers (European or American) have made only small profits (!). The following calculation, based on published sources, contradicts this pair of authors. According to Pereira (1895), combined with the same Herold and Rines (2011) and recalculating the values on the website www.historicalstatistics.org, carbonado was sold in Lençóis to a Captain José Bezerra de Cerqueira for R$ 100:000$000 (read "one hundred contos de reis"), as Serre (1913) claims. Or €720,000 in 2024 (although any conversion of currency between two such dissimilar environments and eras is fundamentally flawed). The captain sold it to the merchant Joaquim Alvaro Bernardes, alias Bolachão, in association with other *capangueiros*, for the sum of one hundred and four contos de reis, a 4% profit.

3. C. Kahn *vs.* C. Kahn

Pereira (1895) quotes the French newspaper "*Le Figaro*" which mentions "Srs. Kahn & C., of Paris" as the buyers of the giant stone ("MM. Kahn et Ce de Paris" in the retrieved original French edition of 8 August 1895, p. 2). Other authors mention "C. Kahn" (Moissan (1895b) or "G. Kahn" (Herold, 2013 and Wikipedia, which includes this author). This Kahn is described as a jeweller (Ganem, 2001) or an exporter (Furniss, 1902).

Despite extensive research between Paris and Bahia, identifying the "C. Kahn" in question is proving difficult. In fact, there were several companies called "Kahn et Cie" (or names derived from it) that were involved in the diamond trade in Paris.

Figure 101 . On the left, Jules Kahn surrounded by his family (probably his wife Adeline Wolf seated and his mother-in-law Mélanie Wolff standing) before 1887 (family photograph kindly provided by Patricia Haas). These Kahn family members of Moselle origin (Phalsbourg) emigrated to the United States, according to the New York *Migration Records* dated 30 March 1866; according to the *10th California Census Record Indexes* of 1880, they were established as drygoods merchants in San Francisco (1418 Post St. in the *Western Additions*, where a large Jewish community gathered); then they returned to France in 1887 (I have not been able to find their company precisely between 1887 and 1913). On the right, the Phalsbourg war memorial known as the "Trois sièges" : front view and rear view showing the plaque revealing the participation of, among others, the Kahn family via Charles; photos (slightly modified) by Didivo67 (Wikimedia Commons, Creative Commons Attribution-Share Alike 4.0 Int.al licence).

According to the newspaper "Cosmos" (no. 1490 of 14 August 1913, p. 252), only the company "Kahn et Cie", based at 60 rue de la Chaussée d'Antin in Paris, was involved in the import-export (Bahia-Europe) of "carbons" alongside Sanders and Ulmann. Herold (2013) mentions several other Parisian companies involved in the "carbon" trade, but only one is named Kahn, the one mentioned above. The magazine "Le Courrier" (7 February 1919, p. 2) stated that "Kahn et C^{ie}" is run by a certain Jules Kahn (1847-1937), together with his children André and Florence (Figure 101). Jules had an older brother, Charles (1846-1929), with whom they emigrated to the United States between 1866 and 1887. Charles is possibly the "C. Kahn" mentioned by Moissan (1895b). The newspaper "Cosmos" also mentions that they had a "branch in Bahia (Brazil)", which seems to be a lead compatible with Yawger (1907). However, neither the Parisian house (nor its Bahianese branch) remains identifiable in the Parisian commercial almanacs prior to 1913 (and in any of the Brazilian equivalents consulted, period 1880-1940).

In Bahia, a company called "C. Kahn & C." existed in Salvador, at least from 1885 to 1891 and from 1892 to 1897. It was founded by Coschel Kahn (1841-1912), an important figure in the Bahia Jewish community until 1887 (Bulletin de l'Alliance Israélite Universelle, IIe série, 20, 1 January 1895, p. 132), when he was president of the Jewish community for a time (at least from 1886 to 1889). In his advertisements (available on the memoria.bn.gov.br website), he announced that he bought back gold and silver and sold European jewellery (Figure 102). Coschel Kahn travelled to Europe in 1892 and then returned from Bordeaux on board the mail steamer Orénoque, as confirmed by the immigration list dated 1 July 1892 in Bahia, where he is registered.

In short, it is not clear from the many sources consulted which "C. Kahn" (Coschel in Bahia or Charles in Paris) bought the black diamond and how it arrived in Paris. This is due to the discretion that systematically prevails when expensive goods are bought/sold and exported/imported, particularly in the eyes of customs and tax authorities. Hérold (2013, p. 12) reconciles the two points of view by asserting that *Joalheria Kahn* in Bahia sent it to "G. Kahn" in Paris (without citing his sources and without noticing his error in the initial

of the first name). He thus implies that *Joalheria Kahn* acted as a local agent of the Kahn's in Paris (but I am not sure that it is actually that simple).

JOIAS
C. KAHN
SUCCESSOR
DE
C. KAHN & C.

Communica ao respeitavel publico e a seus freguezes e amigos que continúa com o mesmo ramo de egocio, de sua antecessora—de venda de joias e brilhantes importados da Europa--assim como relogios de ouro e prata dos melhores fabricantes--no seu escriptorio á rua do conselheiro Saraiva n. 34, por cima da loja Fortuna—recebendo constantemente o melhor sortimento; palo que protesia vender o mais barato possivel e proceder com toda a lealdade, em vista do que espera—que continuem a honral-o com a costumada confiança.

COMPRA IGUALMENTE
OURO. PRATA
Em obras velhas, sempre por maior preço do que qualquer outro.

Attenção

Coschel Kahn, por contracto social, datado de 2 de abril ultimo, registado no tribunal do commercio, associou-se com Mathias Ulmann, no negocio de compra e venda de prata, ouro e joias e transacção de cambio, já estabelecida no predio n. 34, á rua Conselheiro Saraiva, cuja firma social é a de C. Kahn & C., usada por ambos os socios; e por isso avisa ao respeitavel publico e ao commercio, em especial.

Bahia, 4 de maio de 1892.

C. Kahn.
Mathias Ulmann.

Ao commercio

A commissão liquidante da *Companhia Metropolitana da Bahia de Construcções Technicas e Obras Publicas* faz saber á praça que tendo de liquidar a mesma companhia por deliberação de assembléa geral extraordinaria dos srs. accionistas do dia 20 de abril p. passado, convida por isso a todos os credores da dita companhia a apresentarem suas contas competentemente legalisadas, para

casa nos fundos da mesma para seccar café. Uma outra no mesmo arraial, na praça da Egreja, com dois dividendos, sendo um para familia e outro com armação para venda ou loja.

Quem pretender dirija-se ao mesmo arraial a entender-se com o sr. Silvestre José de Sant'Anna, que tem auctorisação para fazer a venda.

CAMBIO

C. Kahn, regressando da Europa a bordo do *Orénoque*, communica aos seus freguezes e ao publico em geral ter escolhido nos principaes mercados europeus uma bonita **collecção** de joias, que vende por preços vantajosos.

Outro sim—continúa a comprar **moedas** de todos os paizes, de ouro e prata, por preço superior a qualquer outro comprador, assim como **ouro, prata e brilhantes** em obras velhas.

Figure 102 . Three inserts from the " Joalheria Kahn" de Bahia: on the left, an extract from the Diaro de Noticias (No. 287, 5 November 1888, p. 3); on the right, two advertisements from Coschel Kahn's company (Jornal de Noticias BA, No. 3735, 5 May 1892) in which he announces his partnership with Mathias Ulmann, who was to become the Moselle-based Kahn's major Parisian competitor in the carbonado trade from 1913 onwards. In the other advertisement, Coschel Kahn announced that he was returning aboard the Orinoco (from Bordeaux) with new jewellery, which he promised to sell at a favourable price, and that he would continue to buy gold, silver and "antique" brilliants (which he necessarily bought from garimpeiros and capangueirosat low prices in Brazil and sold at a higher price in Europe to the jewellers from whom he bought the jewellery that he sold to the Bahian bourgeoisie with the aura of European production). Sources: memoria.bn.gov.br.

When the large black diamond was found and sold in Salvador between July and September 1895, it therefore seems possible that Coschel acquired it, or at least that it was displayed in his shop. However, the archives of the period show that this trader commonly advertised his business in various Bahian newspapers, concentrating on the sale of European jewellery and the purchase of "old" (to be recycled) gold and silver. Industrial black diamonds were not his stock in trade, and he makes no mention of the exceptional acquisition of this large carbonado or of any other diamonds. Furthermore, Brazilian

immigration records from this period show no movement by Coschel between Brazil and France.

4. From Bahia to Paris

A dispute between "carbon" traders reveals the background to the migration of the great carbonado from Bahia to Paris. Curiously, these facts have never been reported in their entirety. This is probably how the actions that brought the carbonado-monster to Paris unfolded.
The dispute arose from allegations made by Jacques Baszanger, a diamond merchant born Isaac Louis Joseph (1870-1942). This Dutchman from Amsterdam emigrated to Paris where he made his living, becoming a diamond merchant like his Amsterdam father Salomon. In January 1895, Baszanger (Jacques) et Cie took over from his father Salomon, a diamond merchant who had ceased trading in the winter of 1894 (he died on 10 June 1896, aged just 55). Jacques, aged 25, quickly refocused his attention on black diamond tools (turning, glazing, mining; Figure 103). However, Ménard F.A. et Cie had already been established for many years in the manufacture of saws, drills, drills and other black diamond, carbon and boort tools. To build his new legitimacy, Jacques Baszanger took over Gustave Daumas's company, which had been founded in 1840 but closed down in 1888. In his first advertisements, he was able to claim the title of "the oldest house of its kind" in Paris. Jacques had a strong sense of how to communicate in order to establish himself, a detail that would prove very important in the years to come.

It all began with Furniss (1902), who claimed that the large carbonado was sold and then broken in Paris. As Jacques Baszanger's company was based in Paris, some concluded that he broke the carbonado in order to resell it in the form of fragments of a few carats, which were highly sought after by industry. However, a London merchant, J.K. Gulland (1835-1921), claimed authorship (Gulland, 1902). Baszanger replied (1906, 1909a) but was contradicted by Yawger (1907) and then Gulland (1909), who both claimed that Baszanger had nothing to do with the affair and that he was scandalously taking "credit" for breaking and dispersing the large carbonado. These squabbles between merchants forced them to publish the far more important details of the voyage of the large carbonado from Bahia to Paris. Here is the reconstructed chronology of events.

Figure 103 . Baszanger advertising inserts in the Parisian Annuaire-Almanach du commerce... (1900 and 1911). Note the temporal and spatial evolution of the iconography. Sources: Gallica (BnF).

Around 20 July, C. Kahn & Co. in Bahia bought the specimen for 121,000$000 contos de reis (121,000 *milereis* or $25,400 at the time; Furniss, 1902; or $930,000 today) from the *capangueiros*, who made a margin of around 15%. Kahn had a photograph taken of the specimen in his jeweller's shop in preparation for its resale. A certain Frank Dennis, a local commission agent for the purchase of black diamonds, sent the photograph to the New York parent company of Victor Bishop & Co. Ganem (2001, p. 61) confirms that the carbonado was "*fotografado em seu tamanho natural na Joalheria Kahn, conforme registro no Boletim da Agricultura - 1909, abril/junho*." (photographed in its natural size at *Joalheria Kahn*, as recorded in the *Boletim da Agricultura* - 1909, April/June). This magazine, after extensive research, turns out to be the *Boletim* of the *Directoria da agricultura, viação, industria e obras publicas* de Bahia. It actually shows (p. 126) the caption for a photograph entitled "*Photographia do grande carbonado extrahido em 1895 no Brejo da Lama (Lençóes) tamanho natural*" (Photograph of the large carbonate extracted in 1895 at the Brejo da Lama (Lençóes) life size).

Next, Yawger (1907) states that "Messrs. Kahn & Co. of Bahia" failed to sell the giant carbonado to Victor Bishop & Co. of New York. The reference

to "Messrs" (condensed form of "Messieurs", the plurial form of Mr. in French) is troubling because there was only one Mr. Kahn in Bahia: Coschel. However, he was associated with his company "C. Kahn & C." with his nephew Mathias Ulmann (1861-1929), who had also immigrated from Alsace at the age of 16 and whom we will discuss at the end of this chapter. So "Messrs. Kahn & Co" in Bahia could therefore have been Mathias and his uncle Coschel. The deal fell through because Victor Bishop & Co. were inexperienced in the tricky business of fracking, which can lead to irreversible losses and bankruptcy given the sums invested (Yawger, 1907). This commercial failure can be dated to around 25 July, ten days after the discovery of the great black diamond.

Coschel and Mathias then turned to Jacques who explained in English (Baszanger, 1909b): "*At the time Mr. C. Kahn, who is a personal friend of mine, knew so little what to do with the large stone, and depended so much on my mediation in its disposal, that he consulted me as to the advisability of selling the stone to the Brazilian He Government, who wanted it for the State museum. He telegraphed to me on July 27, 1895, on the subject* ...".

It's hard to imagine Coschel Kahn buying a carbonado at such an extravagant price and then "not knowing what to do with it". It is obvious that C. Kahn bought the black colossus because he knew two potential intermediaries for its resale in the northern hemisphere: Franck Dennis (in Bahia for New York) and Jacques Baszanger (in Paris). Baszanger gave himself away by confirming that Kahn was a personal friend: the reverse must have been true for Coschel who had Jacques as a close friend, including in business. Franck was the first to be contacted because, unlike Jacques, he lived locally. On 27 July, Coschel was clearly hesitating between the Brazilian government and Jacques. As a Brazilian resident, it's best to avoid going against a government's wishes, even if they pay off badly, late and randomly. The official request was, of course, publicised by Brazilian politicians to flatter national sentiment, as relayed by Pereira (1895) and "Le Figaro" (edition of 8 August 1895, p. 2). The museum institution envisaged is undoubtedly the National Museum of the Federal University of Rio de Janeiro, following the example of the Bendegó meteorite (Figure 104), an iron classified IC according to specialists, weighing 5 tonnes and measuring 220 centimetres long, discovered

in 1784 and which, seven years earlier, found its way from Monte Santo (Bahia) to this museum (where it withstood the terrible fire of 2018).

Figure 104 . The Bendégo meteorite: its original Bahian site (flooded, 1888), its transport and its exhibition at the Rio de Janiero Museum (in 2011, before its fire in 2018). Source: Carvalho (1888) and Tristan Weddigen (Wikimedia Commons; Creative Commons Attribution - Share Alike 4.0 International).

We can imagine that Jacques suggested to Coschel that he should sell the stone in Paris instead, which for the young intermediary meant a commercial masterstroke, a “beginner's coup” in the real sense of the word. Especially as Coschel has had to borrow at a high daily rate to buy the black

diamond from the *capangueiros*: every extra day reduces the profit in sight.

The Brazilian government's request was obviously short-circuited by Baszanger, who, from Paris, saw (alas!) no personal advantage in enriching the Rio de Janeiro museum. Generally speaking, Brazil, whether imperial or republican, failed to conserve the great Bahian carbonados and other naturalist and scientific treasures, as summarised by Pereira (1901), with the loss not only of the Sergio, but also of the carbonado in its *mundubi* gangue, as we saw earlier. Despite the alarms raised by the politicians of the Ancien Régime about the irreversible dangers of over-developing the colonial mining sector (as we saw in Chapter 2), their Brazilian successors, like the Portuguese Crown, seemed to regard subsoil resources as renewable but secondary to those of the soil, crops and livestock, which were seen as having priority (sugar cane but, above all, coffee and beef).

Why did Coschel choose the young Baszanger as his Parisian commission agent rather than Ménard, who was more prominent in Paris at the time for this trade? Apart from the diaspora, there was the friendship that united Coschel's and Jacques' families. Coschel had to send the carbonado by boat towards the end of July: it took three weeks to get it from Bahia to Paris via Bordeaux. Yawger (1907) indeed confirms that Kahn & Co. shipped the carbonado but adds "to their Paris office". We must therefore conclude that it was Baszanger & C^ie^. I think that the article in Le Figaro (8 August 1895, p. 2) is also wrong when it explains that the carbonado was acquired by "MM. Kahn et C^e^ de Paris": in my opinion, it refers to Kahn of Bahia commissioning Baszanger of Paris, as no Kahn house was known in Paris at the time to deal in black diamonds. Bazsanger (1909b) confirms this by specifying that his company was the only one involved in this trade in Paris, which is confirmed by the Paris trade almanacs of those years.

In Paris, the article in "*Le Figaro*" must have excited a French researcher who is trying to synthesise diamond in the laboratory. The researcher in question was the celebrated French chemist Henri Moissan (1852-1907), who went on to win the Nobel Prize in Chemistry in 1906 for isolating the element fluorine in 1886 (Figure 105).

5. Henri Moissan

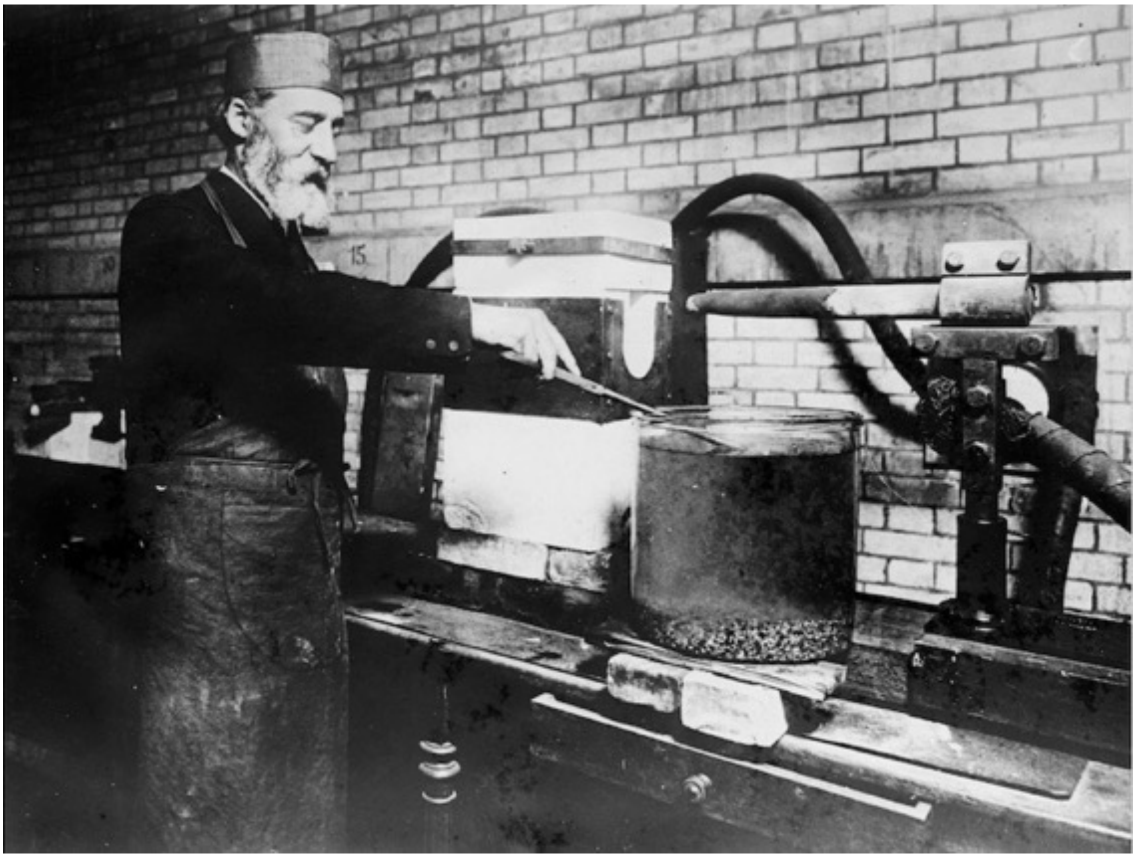


Figure 105 . Henri Moissan “preparing diamonds”. The success of these diamond syntheses (Moissan, 1896) is still open to question because the pressure used was too low. Source: George Grantham Bain collection, Library of Congress, Washington (Wikimedia Commons, public domain).

Henri Moissan was very interested in diamonds in his Paris laboratory at the École supérieure de pharmacie (now the Faculté de pharmacie de Paris and part of the Université Paris-Cité). He needed a wide variety of natural specimens to understand their formation, and hoped that this would guide him towards a synthetic process at a time when heavy industry was using ever more expensive kilograms of carbonado every year.

He carried out his research thanks to the development of an electric furnace capable of reaching 3,000°C (with 450 amperes at 70 volts), a feat that still holds true today. However, it was suspected (wrongly) that the specimen had been contaminated by a synthetic isochemical abrasive, carborundum or silicon carbide (Acheson process, 1891). In his honour, the new mineral named “moissanite” (SiC, trigonal or hexagonal depending on the polytype) that he

identified as carbon silicide (Moissan, 1904; Figure 106) in the Canyon Diablo meteorite (iron, octahedrite, IAB-MG; Arizona, United States) was dedicated to him in 1905.

Figure 106 . A rare box containing thin sections prepared by Henri Moissan on the “diamonds” of meteorites, of which one slide is highlighted, that of the future Canon Diablo moissanite (1904). Paris, MNHN, mineralogy, inv. MIN2011-039.

The chemist also explored the surrounding diamond collections, between museums and diamond merchants, to obtain informative samples from recently discovered deposits in South Africa and Russia. In particular, Moissan “cooked” the MNHN mineralogist of the time, Professor Alfred Lacroix (1863-1948; Figure 107) who was in charge of the collections at the time, to study the contents of the MNHN's diamond drawers. Using various acids and other corrosive chemicals, Moissan succeeded in dissolving diamondiferous sands to obtain, after much effort, a residue composed of clays, platinum, gold and black and colourless diamonds, all microscopic (Moissan, 1896). They also inspected the Canyon Diablo meteorite (Arizona, United States), which also contained a hard form of transparent carbon known as “diamond”: in reality, it was lonsdaleite, a hexagonal polymorph of native carbon (or allotrope, i.e. of the same chemical composition but with a different

atomic arrangement, resulting in different physical properties and a distinct mineral species).

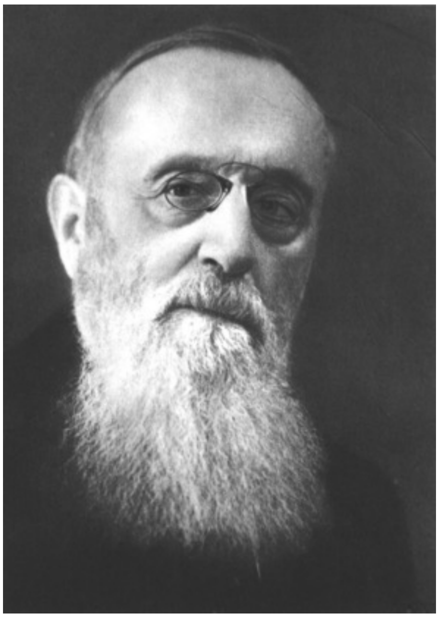


Figure 107 . Studio Harcourt: Professor Alfred Lacroix of the MNHN (in Orcel, 1950). Paris, Muséum national d'histoire naturelle, Bibliothèque Centrale.

Figure 108 . One of the first successes of ruby synthesis at the Muséum national d'histoire naturelle (Jardin des plantes site in Paris) by Professor Edmond Fremy: a crucible lined with rubies and the commemorative plaque (1891, some twenty years later). The rubies produced in this refractory crucible form small hands and thin plates, which are unfortunately unusable in watchmaking. His assistant, Auguste Verneuil, soon found the solution. Paris, Muséum national d'histoire naturelle, minéralogie (PA collection, not inventoried). Photo: © François Farges/MNHN.

The challenges of gemstone synthesis

A scientific vocation for industrial use: the synthesis of "precious" minerals was on the minds of the mineralurgical avant-garde of the time – not for jewellery, as one might imagine at first glance when speaking at diamonds – but for the high-tech of the time: respectively, the manufacture of precise watches on a large scale and of hard tools to compete with the Leschot system, which relied too heavily on natural carbonados that were becoming unaffordable and random. Moissan had been a student and young researcher at the Muséum since the 1870s. Because whoever could make synthetic diamonds and, even more audaciously, the tools to use them, would make a better fortune than the miners, carbonado guaranteed on the nail: this chosen one would in return obtain a patented, hard-earned fame, far beyond that of the more restricted world of diamond cutters. Henri Moissan's teacher was Edmond Fremy (1814-1894), a professor at the Muséum national d'histoire naturelle on the Jardin des plantes site in Paris. Fremy initiated the synthesis of rubies (Figure 108). However, it was another of his former students, Auguste Verneuil (1856-1913), who became his assistant and then a professor at the museum, who fully achieved this 'Holy Grail' shortly afterwards (Figure 109) by his other former student, Auguste Verneuil (1856-1913), who became his assistant and then a professor at the MNHN in a laboratory whose building still stands today (Figure 110).

The challenge was not so much to manufacture synthetic rubies (and other sapphires) for the jewellery industry (Figure 109, right) as to supply rubies of extremely consistent quality for the pivots of watch mechanisms. The Third Republic was seeking to break with the control of time, which under the Ancien Régime had been a religious affair, as evidenced by the clocks on church steeples that struck the quarter hours and governed the people's time. These politicians also sought to equip every man in the household with a watch, so that engineers and later workers could arrive at work on time: these were the pocket watches of the European great-grandfathers and, before them, their parents.

As for Moissan, he claimed to have succeeded in synthesising diamond in the form of microscopic crystals, but his results remain controversial for various experimental reasons (lack of enough pressure).

Figure 109 . On the left, the first corundum “pears” of all colours, including sapphires and rubies; on the left and in the centre, a “failed” sapphire test. On the right, one of the very first faceted synthetic rubies in history (5.1 carats), which earned Auguste Verneuil an invitation to the Presidency of the French Republic with his wife. According to the story passed down from generation to generation at the Muséum, Madame Moissan arrived wearing such an impressive set of synthetic rubies that the wife of the then President of the Republic, who was wearing a much more modest set of jewellery, took offence. It is said to have spoiled the event. Paris, Muséum national d'histoire naturelle, mineralogy, PA collection. Photos: © François Farges/MNHN

Figure 110 . The former laboratory of Auguste Verneuil (in February 2018) on the Poliveau campus of the Muséum national d'histoire naturelle in the Jardin des plantes in Paris. It was here that Verneuil produced the first large gem rubies in history (unfortunately, his equipment was dispersed by his successors: a century later, it is now a molecular biology laboratory). Photo: © François Farges.

The *Carbonado do Sérgio* was of considerable interest to him because its extraordinary volume was more likely to hold the keys to the synthesis of the diamond he was looking for. Moissan (1895a) published a short note in the Comptes-rendus de l'Académie des sciences, followed by various "general public" journals, as if "to mark his ground" but also, I think, to attract public or private subsidies to fund his research.

Moissan is certainly trying to convince the authorities to acquire this monster for science, in other words for his work. He followed this up with an article in the journal "La Nature", in which he reproduced his note *in extenso* and added some additional data (Moissan, 1895b). He continued with his original title, worthy of a chemist: "Carbon noir du Brésil", this time accompanied by an engraving of the "beast" (Figure 111) by the famous illustrator of the time: Henri Thiriat (1843-1926).

Figure 111 . Henri Thiriat: illustration of Sérgio's carbonado for Henri Moissan's article (1895b) in "La nature", reprinting in extenso his note of the 23rd of September (Moissan, 1895a) and adding this engraving. Source: Paris, Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. Pr 316.

6. The "carbon.e" chronicles

Although he was not a mineralogist *per se*, Moissan knew the name of his mineral, carbonado, as he mentions it several times in his articles. However, he preferred the term "carbon", possibly to attract some wealthy patron from the world of industry. Industrialists also used the word "carbon", and we saw the appearance of shares in a "Compagnie franco-brésilienne de diamants et de carbones" (Franco-Brazilian Diamond and Carbon Company"; Figure 112), which was looking for investors to exploit the deposits in Bahia. However, the word "carbonado" is already commonly used in English and in French to refer to this type of diamond originally found in Brazil (Jacobs and Chatrian, 1884). However, these semantic variations will have dramatic consequences for the next episodes.


COMPAGNIE FRANCO-BRÉSILIENNE
DE DIAMANTS ET DE CARBONE
Société Anonyme au Capital de Sept Cent Mille Francs
SIÈGE SOCIAL: 71, RUE DE PROVENCE, PARIS
PART DE FONDATEUR AU PORTEUR
Numéro 0.174
Les parts de Fondateur au nombre de trois mille représentent 33% (trente trois pour cent) des bénéfices et 30% (trente pour cent) de l'actif en cas de liquidation ainsi qu'il est dit d'autre part.
Un Administrateur
Un Administrateur
Paris, le 1901

Figure 112 . Shares in the Compagnie franco-brésilienne de diamants et de carbone (carbonado). This company probably did not prosper as no information has been found about it. Private collection (with permission). Photo

The journalist Henri de Parville (1895) lyrically summed up the scientific thinking at the time, which already foresaw the controversy between terrestrial and extra-terrestrial origins (helping then Moissan to find sponsors): "This black diamond is identical in composition to those obtained by Mr H. Moissan in an electric furnace, which once again argues in favour of its igneous origin

and its provenance from the depths of the globe. Moreover, meteorites, which appear to be pieces of broken stars, sometimes contain varieties of graphite and even black diamond. In the sky stone collected in August 1886 at Novy-Urej (Russia), Messrs Jerofeieff and Latchinof isolated grains of black diamond; the same was observed in the Cañon Diablo meteorite. It is probable that these samples, which come to us from space, must also sometimes have belonged to the central part of broken stars. In any case, this is yet another example of the uniformity of the composition of matter on different worlds. Diamonds on our planet and also diamonds formed or in the process of being formed in stars that gravitate like us in the depths of the sky!" By referring to Moissan's research into the formation of diamonds with a view to their synthesis (which was announced as a success when he combined temperature and pressure: Moissan, 1896), this columnist also generalised the chemist's work to extra-terrestrials. This hasty generalisation is still popular with a number of journalists and auction houses, who are posting more and more eye-catching ads on these subjects, even today.

When the specimen was presented to the Académie des Sciences on the 23rd of September, it was verbally announced that a cast would be made and donated to the Galerie de Minéralogie at the Muséum (Journal Officiel de la République Française, 3 October 1895, p. 5813). However, Moissan did not mention this casting in his writings, which confirms that he was looking for a patron to acquire the original. This last publication compares the specimen to a block of slate from the Angers area (!). By a curious coincidence, the newspaper entitled "L'Anjou" (19 October, p. 2) picked up the story, as did several other regional dailies in unison with the capital. But the Anjou paper wisely added that it would be wise for Moissan – since the crushing of this carbonado was inevitable – to buy later some fragments for his experiments. Unfortunately, to the best of my knowledge, this judicious suggestion never materialised. Two years later, Babinski (1897, p. 14) stated "... a cast exists in the collections of the Museum of Natural History in Paris, reaching 3,167 ½ carats."

Sixteen years went by and then the French consul in Bahia, Paul Serre (1913, p. 135), added: "Before breaking this enormous piece of carbon that no

museum agreed to buy, two casts were taken. One of them is kept in Paris and the other at the Historical and Geographical Institute of São-Salvador”. Serre does not give any information about the first place it was kept, other than that it was in Paris. The laconic resentment of the French consul is deafening (he is a diplomat) even though we have known the location perfectly well since Babinski (1897). In my opinion, he is aiming his words at the Museum, its president Milne-Edwards and Professor Lacroix, who was one of the five greatest French scientists of the time. They were presented to King Don Charles I of Portugal and the Algarves (1863-1908) in 1906 during his visit to the Museum (anonymous, 1906), which also included the following four Nobel Prize winners (or future winners): Henri Becquerel, Marie Skłodowska-Curie, Gabriel Lippman and Henri Moissan (except Lacroix, as there is still no Nobel Prize as such for the geosciences, still today). Unlike Marie Curie, who was brief, Lacroix was the one who spoke to the sovereign at greatest length. This awkward protocol reflects Lacroix's isolation from others (some historians even speak of a form of autism).

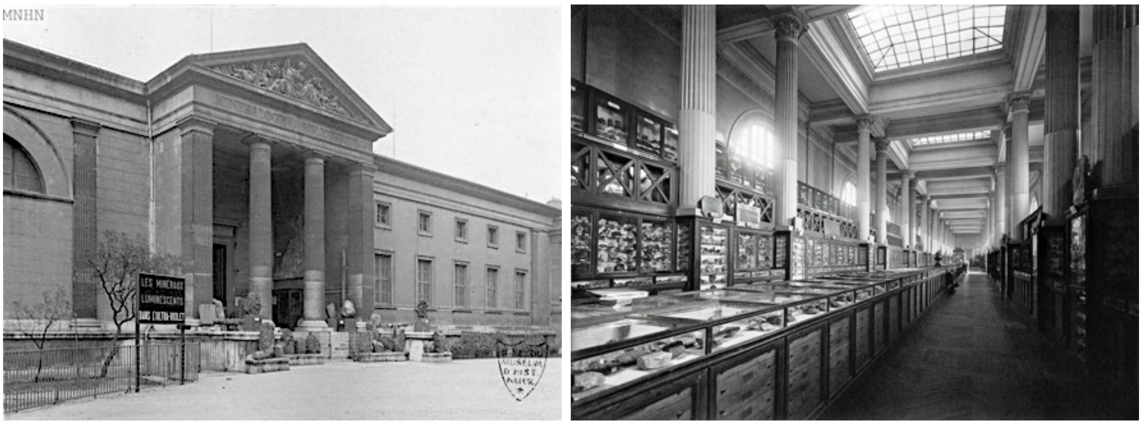


Figure 113 . The Galerie de Minéralogie at the Jardin des Plantes: (left) outside in 1935 and (right) inside in 1924, showing the Great Nave after Lacroix's museologic reorganisation in the years 1895. Source : Paris, MNHN, Bibliothèque Centrale, inv. IC573 and BnF, Agence de presse Meurice/Wikimedia Commons.

7. A missed opportunity

Was it Lacroix's acknowledged modesty (Orcel, 1950) that prevented him from acting, but made him talk too long? Lacroix was appointed professor at the MNHN in 1893. To take account of new discoveries and theories in mineralogy, he decided to reorganise the layout of the Great Nave of the Galerie de Minéralogie in the Jardin des Plantes in Paris (Figure 113). This reorganisation probably led to the gallery being closed for long periods in 1894 (Lorand, 2013).

However, diamonds no longer attracted the interest of this brilliant researcher, who was nevertheless devoting his work to rocks and essential sources of information on the genesis of minerals. Moreover, he seems to have been more interested in islands (Santorini, Madagascar, Martinique, Réunion, the Pacific archipelagos or Los in Guinea, etc.) than in ancient continental masses (Brazil, Central or Southern Africa, Australia), which he did not prospect, despite the fact that he travelled extensively from island to island. What is more, I find it hard to see Lacroix canvassing the ministries for “political” funding as actively as his predecessors, such as Alexandre Brongniart (1770-1847) and Armand Dufrénoy, who inundated the Administration with skilfully argued requests – in which anything would do – notably for the construction of the new mineralogy nave (1833-1839), or to recover the historic collections of Haüy, the Monnaie de Paris or Romé de l'Isle (according to my consultations of the MNHN archives at the Archives nationales in Pierrefitte-sur-Seine). Lorand (2013) adds that 1895 also corresponds to the start of prospecting in the new French colony of Madagascar, which provided Lacroix with more funding. Finally, the chronic shortage of staff and funding, particularly in comparison with the United States (Carnegie, Stanford, etc.), which was then providing many researchers with high-performance laboratories, heralded the decline of French science compared with German or British science.

To Alfred Lacroix's credit, *Sérgio's carbonato* is (very) expensive: 150,000 francs is equivalent to fifteen years of his salary, or around 1.5 million euros today. And this specimen – as it appears in his illustration at the time – is not

so “spectacular” mineralogically speaking. Only private collectors have the audacity – and the vision – to acquire minerals at such prices. On the institutional side, it is all a question of will. This sum seems almost trivial for a masterpiece of painting or a sumptuous piece of jewellery of the kind that Empress Eugénie bought so many of (there is talk of more than six million francs spent on jewellery just in 1855...). The Museum's recurrent lack of financial resources is just as dramatic a contributing factor. Since then, the Museum has usually been run by a specialist in living things, including the physician and zoologist Alphonse Milne-Edwards (1835-1900) in 1895. The purchase of a mineral did not seem to be of much concern, especially as the price asked easily surpassed the cost of a gazelle skeleton or the upkeep of an elephant in the menagerie.

Diamonds & Politics

The rarity of diamond specimens in natural history museums makes them a secondary subject of study for many curators, even today. Compared with native gold, which is often well represented by crystals or nuggets, diamonds are often the poor relation in these collections because of their high price and the rarity of donations, particularly in France. Parisian diamond dealers have access to these minerals, which mineralogists ignore, if not some gemologists for the duration of an expert report. Around 1925, important gem diamonds and carbonados were discovered in the Oubangui region, now the Carnot-Nola-Mbaiki triangle in the south-west region of the Central African Republic ((Figure 114). However, none of them entered the collection except for the very first one discovered (inv. 114.349), followed by small crystals (inv. 131.279). According to Orcel (1950), Lacroix – who was in charge of the collections at the time – complained that he was too absorbed by the administrative tasks associated with his position as Permanent Secretary of the Académie des Sciences. Why did not he resign? Possibly because of a recurring lack of funding at the Muséum, which could be compensated for by his prestigious position within the Institute.

Figure 114 . Three specimens (4 to 5 carats, centimetre size) of carbonado from the south-west region of the Central African Republic, between Bangui, Carnot and Berberati. The MNHN has no samples of these, despite the French presence in Equatorial Africa until its independence in 1960. They are currently being (laser- or not) cut for jewellery. Photo: © James St. John (Wikimedia Commons license, Creative Commons Attribution 2.0 Generic).

8. Two casts (out of 5)

When the specimen was presented to the French Académie des Sciences on 23 September 1895, Moissan only mentioned its owner, "C. Kahn", but never "J. Baszanger", despite the fact that this commissionaire had had to logically hand-deliver the carbonado to the professor for the session on 23 September, which the merchant was even able to attend (given the value of the specimen). There is a need to separate science and commerce, and perhaps also a mutual denial.

The making of a cast was also announced verbally (but recorded in the Journal Officiel de la République française of 3 October 1895, p. 5813) with a view to its donation to the Galerie de Minéralogie at the Muséum. However, Moissan did not mention this casting in his publications, which might indicate that he was looking for a patron to acquire the original. The official French publication also compared the specimen to a block of slate from the Angers area on the Loire valley (!) By a curious coincidence, the newspaper L'Anjou (19 October, p. 2) picked up the story, as did a number of other regional dailies in unison with the capital. But the *L'Anjou* newspaper added that it would be wise for Moissan - since the crushing of this carbonado was inevitable - to buy some fragments for his experiments. Unfortunately, to the best of my knowledge, this judicious suggestion never materialised.

The night following the announcement of a cast for the Muséum at the the Académie des Sciences session on the 23rd seemed too short to allow the object to be made, as Sergio was officially sold the next day (Baszanger, 1909a,b). The date was certainly no coincidence: it was necessary to avoid commercial interference with the scientific discourse of 23 September. But no one was fooled: there was no doubt among the journalists present at this session that Sergio was going to be fragmented and therefore lost. His fate was already sealed on the 23rd, despite Moissan's attempts to publicise his purchase for science and to mobilise politicians and public opinion, to no avail. The chemist must then have had no hope of keeping this specimen in France for science, which explains the hasty announcement of its casting, which was the only possible solution, for want of anything better.

Two years later, Babinski (1897, p. 14) stated that (translated) "... a cast exists in the collections of the Museum of Natural History in Paris, reaching 3,167 ½ carats". Sixteen years went by and then the French consul in Bahia, Paul Serre (1913, p. 135), added (translated): "Before breaking this enormous piece of carbon that no museum agreed to buy, two casts were taken. One of them is kept in Paris and the other at the Historical and Geographical Institute of São-Salvador". In contrast to Bahia, Serre does not give any information about the first place it was kept, other than that it was in Paris. The laconic resentment of the French consul is deafening (he is a diplomat) despite the fact that the location had been known perfectly well since Babinski (1897). In my opinion, it is directed at the Museum, its president Milne-Edwards and its professor and curator of the mineral collection, Alfred Lacroix.

On the Brazil side. The second place mentionned by Serre (1913), the *Instituto Geográfico e Histórico da Bahia* (IGHB) is, more precisely, its *Museu* (museum). While the MNHN was de facto announced as the recipient of the single cast announced by Henri Moissan on 23 September, the IGHB does not appear to have been originally involved in this deed of gift. We can therefore suspect that Coschel Kahn asked/ordered for a second cast to be made for the Bahians, perhaps to clear his name with the Brazilian government. On rereading Pereira (1901), one senses a great deal of bitterness towards this Frenchman, who is said to have stolen (he uses this word) the great carbonado from his native Brazil, while forgetting to mention that it was the Brazilian *capangueiros* who sold it back to Kahn in Salvador, the capital of Bahia (translated from Portuguese). Pereira (1901) further adds (translated) "In this capital it was exhibited for many days in the jewellery shop of Mr Kahn & C., where it was appreciated to the point that a distinguished citizen became interested in its shape in solid silver, a work of art from Paris, and offered to the Institute by his worthy wife, when he had been unexpectedly stolen from the bosom of the living and from his country, which had lost so much with his disappearance." Alas! this text is so beautifully written that it is terribly lacking in precision. Who is the wife of this "distinguished citizen"?

The 1909 *Boletim* (of the *Directoria da agricultura, viação, industria e obras*

publicas, Bahia, 12-13, p. 4), in which the wife has disappeared in favour of the husband and his favourite, a coronel, provides the beginnings of an explanation (translated): "The Historical Institute has preserved its silver model thanks to the initiative of colonel Rogaciano Pires Teixeira and a donation from former senator Costa Pinto". To conclude these two articles, it would appear that Kahn & C. received a silver cast from Paris, made by some Parisian artist. It was exhibited in their shop for several days (around 1895-1896) and then sold it to the only known senator from the state of Bahia to fit this description, namely Joaquim da Costa Pinto (1843-1894). Except that this senator was already dead in 1895 (another Pereira's approximation!), so we will consider his widow instead, Sophia Henriqueta Macedo de Aguiar (1852-1931), who then may have donated the cast to the IGHB. The IGHB website says nothing about this; I have contacted the institute on several occasions, through various channels, without success.

On the British side. The next chapters will illustrate the subsequent production of at least three more castings, this time on the British side.

9. Gulland

Baszanger in turn tried to sell the giant carbonado from Paris to Victor Bischop & Co, but to no avail. But the diamond was finally sold on 24 September 1895 by Baszanger, ostensibly “on paper”, while the cast (and later the second cast) was made. The buyer was James Ker Gulland of Westminster, i.e. the Diamond Drill Co. then based at 8 Victoria Street in London (Figure 115). Gulland specialised in black diamond drilling tools (also known as “carbon”). He bought it for ₤6,464 (Gulland, 1902), i.e. around €1.9 million today (+55% of the amount paid to Sérgio in 1895). It should be pointed out that this difference includes the margins of successive dealers, Baszanger's commission, as well as incidental expenses including the cost of transport, which was always by special courier, export duties, freight and insurance (Furniss, 1902). Note also that Kunz (1904, p. 821) and Cattelle (1911, p. 190) are mistaken when they state, respectively, that the carbonado was sold to Gulland on 19 or 15 September 1895 (whereas Gulland claims to have bought it on the 24th, as indicated above).

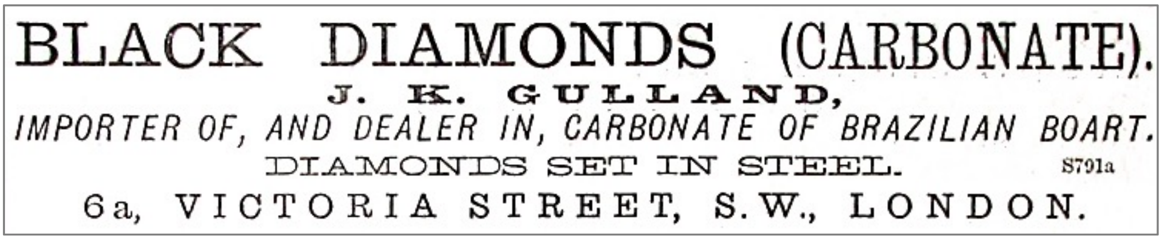


Figure 115 . Advertisement published in the 2 January 1880 issue of The Engineer” before his company, the Diamond Drill Co, moved to 8 Victoria Street, London. See how carbonado is confusingly spelt "carbonate of Brazilian boart".

The French authorities, the Muséum and the State, still did not budge when this carbonado crossed the Channel. The carbonado had clearly arrived in London on 14 December when Gregory (1895) described it: “It had a dark, brownish black colour, slightly polished on some of its angular surfaces, as is usual with examples of this variety of diamond. On being fresh broken the colour is of an ashen grey or somewhat fawn colour, and very uniform in texture, very nearly compact, or being only vary slightly cellular; some

specimens have bright glistening specks throughout, though it was not the case with this piece." This description informs us that Sergio has obviously already been broken, at least in part. In addition, this information more or less coincides with that of Moissan (1895a,b), who describes it as "of a very frank black".

According to research by Hansen et al (2024a,b,), two new casts were made between 1895 and 1902 on the banks of the Thames and given to two English museums: the British Museum (Natural History) and the Museum of Practical Geology. The latter was absorbed by the former, which became the current Natural History Museum, and which still has its two replicas, slightly later than the French one. These two casts are illustrated in our second Australian Gemmologist paper (Hansen et al., 2024a).

At least, one other cast was obviously made (Figure 116, Reed, 1930). The label on this cast suggests that Gulland commissioned some from Gregory for the American customers of his branch in Duluth, Minnesota (USA).

Figure 116 . Photograph published by Reed (1930) of a cast of Sergio labelled "MODEL OF LARGEST CARBON/EVER FOUND = 3078 CARATS/BOUGHT, BROKEN UP & SOLD BY/GULLAND, LONDON, SW & DULUTH, MINN., U.S.A." This photograph appears to have come from a sales brochure for the R.S. Patrick Carbon Co (Duluth, USA), which was used (in an approximate drawing) in an article by R.A. Jones (1929) "Black Diamond" du Oil Weekly 53(6), p. 35. Source : HathiTrust.

10. Battles for the honour of Sergio's destruction

In 1902, Sergio was fragmented into small fragments of 1 to 4 carats (Hansen et al., 2024a), mainly for the Leschot system (and its copies), which used 6 to 8 per drill bit. Gulland boasts that he has made a substantial profit by selling it in fragments of 3 to 6 carats (around 700 lots, the equivalent of €2,500,000 today). It is the only example of a diamond whose price increases considerably after it has been broken! Just five years later, Furniss (1906) estimated that its value had quadrupled! In the same year, Baszanger (1906) even estimated a factor of seven. Baszanger (1909b) also explains that he bought 600 carats worth of fragments of Sergio from Gulland, a consideration they had negotiated beforehand during the September 1895 sale: we would have appreciated donations of small fragments to natural history museums in Rio de Janeiro, Paris, London and elsewhere. Nothing of the sort, business only as usual, French-style.

On 17 November 1902, James Ker Gulland had an short note published, intitled "Brazilian Carbons" published, his version commenting on an earlier anonymous article entitled "Brazilian Diamonds and Carbons" published in the same issue of the Journal of the Society of Arts (14 November 1902, pp. 928-930): "I have perused, with much interest, the article in your Journal of the 14th November, re Brazilian diamonds and carbons. Regarding the largest carbon ever found, it was not broken up in Paris, I broke it up here myself. The exact weight was 3,078 carats. I bought the stone on the 24th September, 1895, for £6,464, broke it up in pieces suitable for use in diamond drills, and resold the whole at ten per cent. profit. Had I the stone now it would be worth £26,163. The present price of carbon at the mines for good carbons one carat and upwards is £8 10s. to £9 per carat, not £5."

As early as spring 1905, Baszanger advertised his company by illustrating its advertising inserts in American industrial magazines (Figure 117, left), with a little-known, if not forgotten, photograph of a rather dark Sergio. The caption reads: "*Opposite is largest carbone ever found (one-third actual size): was sold and broken up by us*". The illogical nature of Baszanger's statement (it is not easy to sell a carbonado and then break it up) contrasts with that of Gulland,

who more logically states the opposite on the label of a Sergio cast (see Figure 116 : he bought the specimen and then broke it up). Baszanger (1909b), after a few recurrences in various mining journals (including Baszanger, 1906 and 1909a), retracted his statement, justifying himself by repeated errors by his New York employees concerning the fracturing of the giant carbonado. In fact, they may have unwittingly taken up and interpreted the error published by their fellow citizen Furniss (1902), who mistakenly mentioned Paris. But repeating the same mistake in the name of Jacques Bazsanger in the space of three years does not seem to be just an underling's blunder. Nevertheless, a corrected version of the insert was published (Figure 117, right). Baszanger (1909b) even took the opportunity to denounce Yawger's (1907) and Gulland's (1909) denials that he had sold the specimen. Indeed, as a commission agent, he must have sold it without having been the seller. The quarrel ended there, to each his own bad faith.

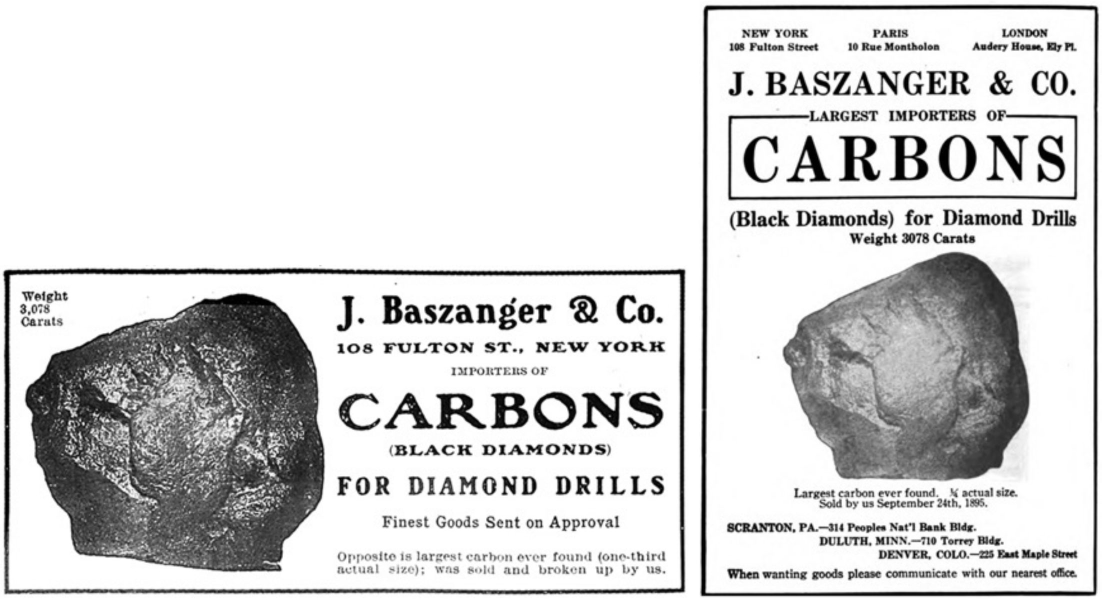


Figure 117. Advertisement for Jacques Baszanger's company in the United States in the Engineering and Mining Journal (1905, 79 (26), p. 84), showing a little-known photograph of Sergio and the basal caption “was sold and broken up by us”. Source: HathiTrust.

11. Sergio is no more except in iconography

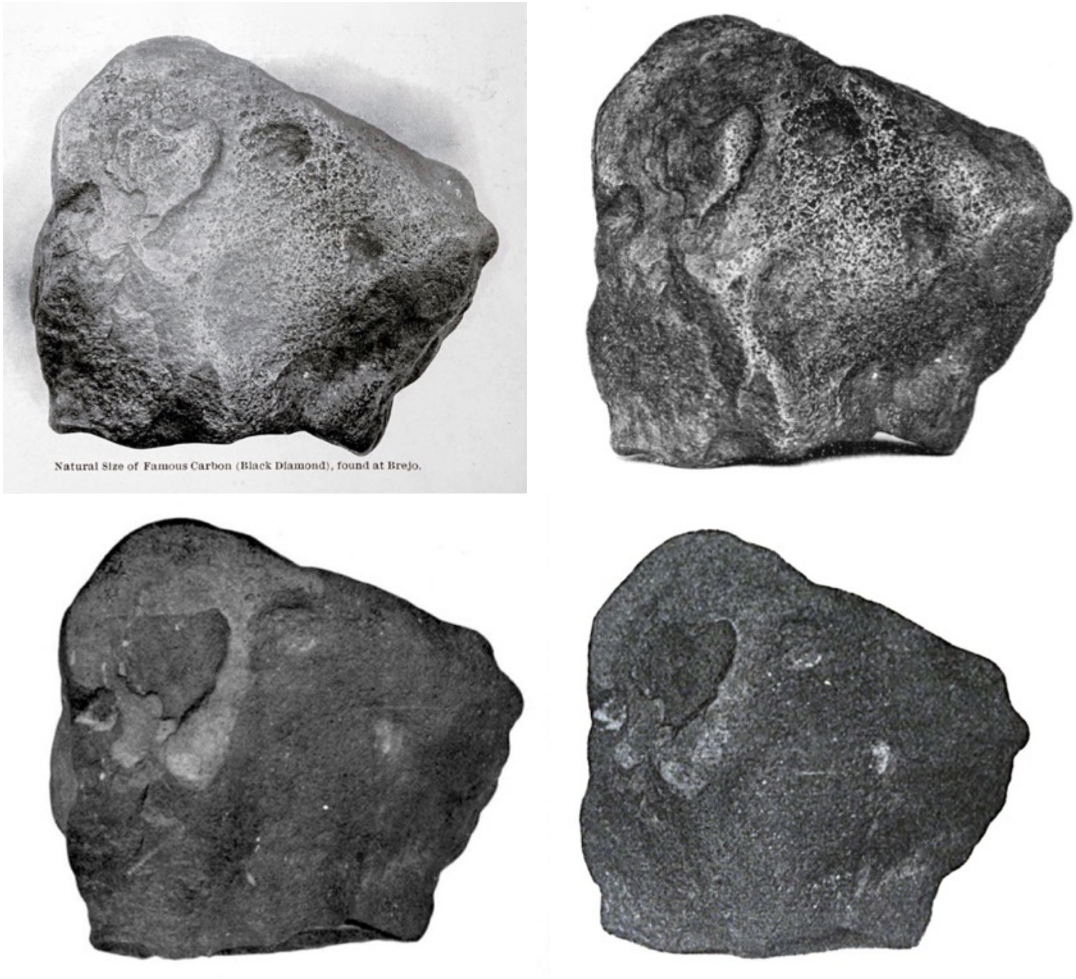
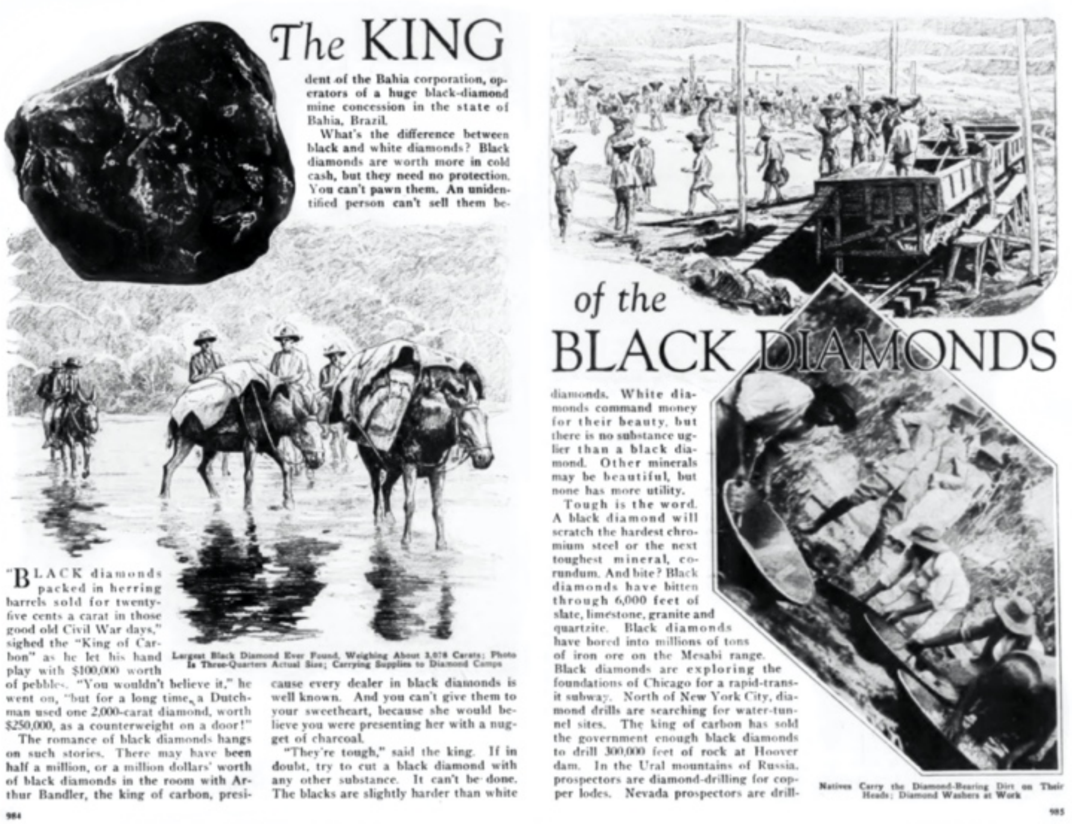


Figure 118 . Four photographs of the Sergio carbonado, published by (above) De Souza Aguiar (1904, p. 11) and Furniss (1906, p. 274) as well as (below) Kunz (1904, Pl. II, pp. 820-821) and Yawger (1907, p. 6). Curiously, they are not similar with noticeable differences in colour, lustre and in many details. Kraus (1911, p. 11) published a photograph purporting to be of this specimen, but it is in fact that of the 750.5 carat carbonado shown in Figure 90. Sources: archive.org. Kraus (1911, p. 11) published a photograph purporting to be of this specimen, but it is the 750.5 carat specimen shown in Figure 90. Sources : archive.org

In the meantime, two photographs (Figure 118, the two above) - close but significantly different in some details - were taken on the opposite side to Henri Thiriat's engraving: they were published for the Lousiana Purchase Exhibition in Saint-Louis (De Souza Aguiar, 1904) and then by Furniss (1906). The second plate has become Sergio's current iconographic reference thanks to its photographic quality. These two photographs complement those taken on the USA side (Figure 118, the two below), published by Kunz (1904) and

Yawger (1907), but little known because of their poor quality (Hansen *et al.*, 2024a). Both of these publications state that the carbonado no longer exists.

Sergio was often confused by many chroniclers with the two largest carbonados known at the time (Kunz, 1904, p. 820). They were discovered in 1894 (975 carats, broken in Paris) and 1901 (750.5 carats, broken in Germany in 1902) respectively. For example, Furniss (1906) confused the first with Sergio (the error was repeated in various publications and corrected by Gulland, 1902). Images of the fragmentation of the second (Figure 66), often confused with Sergio, were published by, among others, Kunz (1904, Pl. III and IV), Bazsanger (1906, p. 857) and Kraus (1911, p. 11).



The KING of the BLACK DIAMONDS

"BLACK diamonds packed in herring barrels sold for twenty-five cents a carat in those good old Civil War days," sighed the "King of Carbon" as he let his hand play with $100,000 worth of pebbles. "You wouldn't believe it," he went on, "but for a long time a Dutchman used one 2,000-carat diamond, worth $250,000, as a counterweight on a door!"

The romance of black diamonds hangs on such stories. There may have been half a million, or a million dollars' worth of black diamonds in the room with Arthur Bandler, the king of carbon, president of the Bahia corporation, operators of a huge black-diamond mine concession in the state of Bahia, Brazil.

What's the difference between black and white diamonds? Black diamonds are worth more in cold cash, but they need no protection. You can't pawn them. An unidentified person can't sell them because every dealer in black diamonds is well known. And you can't give them to your sweetheart, because she would believe you were presenting her with a nugget of charcoal.

"They're tough," said the king. If in doubt, try to cut a black diamond with any other substance. It can't be done. The blacks are slightly harder than white diamonds. White diamonds command money for their beauty, but there is no substance uglier than a black diamond. Other minerals may be beautiful, but none has more utility.

Tough is the word. A black diamond will scratch the hardest chromium steel or the next toughest mineral, corundum. And bite? Black diamonds have bitten through 6,000 feet of slate, limestone, granite and quartzite. Black diamonds have bored into millions of tons of iron ore on the Mesabi range. Black diamonds are exploring the foundations of Chicago for a rapid-transit subway. North of New York City, diamond drills are searching for water-tunnel sites. The king of carbon has sold the government enough black diamonds to drill 300,000 feet of rock at Hoover dam. In the Ural mountains of Russia, prospectors are diamond-drilling for copper lodes. Nevada prospectors are drill-

Largest Black Diamond Ever Found, Weighing About 3,078 Carats; Photo Is Three-Quarters Actual Size; Carrying Supplies to Diamond Camps

Natives Carry the Diamond-Bearing Dirt on Their Heads; Diamond Washers at Work

984

985

Figure 119 . Header pages of a 1931 issue of Popular Mechanics (vol. 56, pp. 984-895) showing, on the left, an iconography of Sergio, seen from the opposite side to that shown in the previous figure. In fact, the object depicted may be the cast that Reed (1930) later published on its stand (see Figure 116). In fact, these two iconographies are extremely similar (but not identical).

However, the title of "*The King of the Black Diamonds*" was attributed to *Sérgio's carbonato* in 1931 (*Popular Mechanics*, 56, 984-986 ; Figure 119). This

article also shows a recently rediscovered image of the carbonado (Hansen et al., 2024b), which sounds related (altough not identical) to the one published by Reed (1930) the year before (Figure 115), i.e. a cast of the King. Because it was then too late, the King was already sacrified many years ago!

12. Kahn, Ulmann and Baszanger: epilogue

What became of Baszanger and the Kahn family? In 1913, things are bout to change: Jacques Baszanger published large advertising inserts, as in the Canadian Mining Journal for instance, showing Sergio on a 1:1 scale and captioned “Sold by us in London, Sept. 24th, 1895”. But this was his swan song. Baszanger quickly lost his status as one of Europe's leading carbon traders. Coschel Kahn and Mathias Ulmann returned to France between 1900 and 1913: the latter founded his own company, Ulmann et Cie, which competed head-on with the Moselle-based Kahn et Cie. Baszanger et Cie never recovered from this French-Brazilian competitors : even though it multiplied its branches in the United States, Jacques did not hold on to its leadership for more than eight years. Clearly, the relationship between the young Jacques and Mathias, the latter being Coschel's protégé, was not as glowing as Baszanger claimed in 1909. Baszanger then diversified into the gem trade, including opals and sapphires from Australia. As did the Kahn family, until the 1920s and 1930s, when their children, Charles Baszanger and Florence Kahn, took over the business. The two “C. Kahn”, Coschel and Charles, died and are buried five metres apart in the Montparnasse cemetery in Paris. Jacques was murdered in 1942 by the Nazis in the Auschwitz concentration camp.

Incomprehensibly, Baszanger is not cited by Herold (2013) because this historian does not realise that he mentions only the Parisian Jewish merchants of the years 1915-1920 as if they had dominated the Parisian market since the 1880s. This lack of precision, which I believe I have unravelled here, has unfortunately fooled us for a long time. These inaccuracies and errors, despite the efforts made in writing and research, are as much the approximations of contemporaries (Furniss, Gulland, Baszanger, Yawger, Pereira, etc.) as of current historians (Herold, Ganem). As a result, the Wikipedia page on the Sergio carbonado, for example, includes many of these inaccuracies.

II. TOWARD MODERN TIMES

BLACK DIAMONDS: FROM AFFECTION TO DENIAL

1. The affection

Ancient authors, including the Roman Pliny the Elder (*Historia naturalis* XXXVII, §4), speak of *adamas*, the invincible, or diamond for some modern authors. Pliny then describes various varieties (in the sense of the time), including one with the lustre of metallic iron, which he calls siderites, while its "weight" [i.e., density] is greater than the others and its nature and properties are different (*Post hunc est siderites ferrei splendoris, pondere ante caeteros, sed natura dissimilis*). Some authors identified *siderites* as black diamond because of their dark greyish colour. But they are no denser than nominal diamonds - in fact, quite the opposite. Another variety with a coppery colour is described from Cyprus, where iron and copper ores were actively mined.

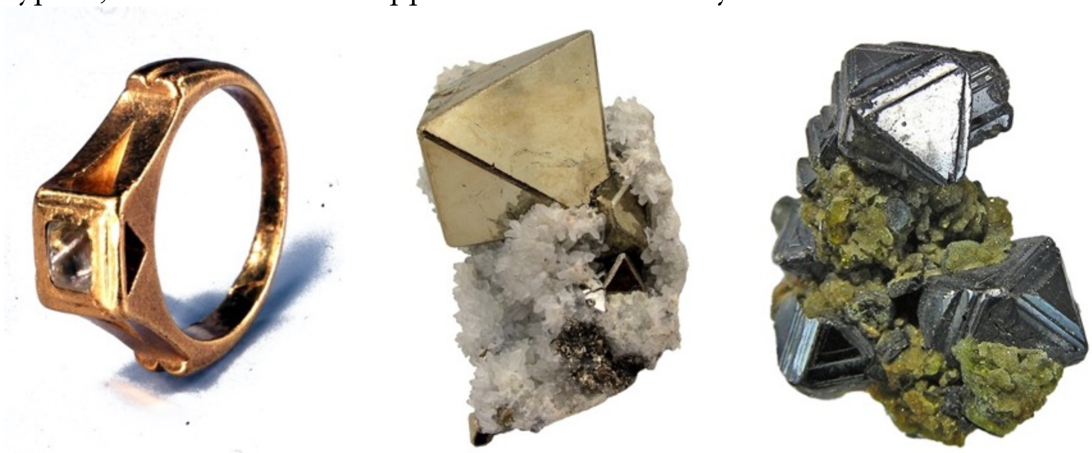


Figure 120 . Left: Roman ring (⌀ 2.5 cm) set with a natural diamond octahedron (India or Borneo; © The Trustees of the British Museum, shared under a Creative Commons Attribution-Non Commercial-Share Alike 4.0 International, CC BY-NC-SA 4.0); crystals (octahedron) of pyrite (H 6.1 cm; (Huanzala, Peru) and magnetite (H: 2.1 cm, cubic octahedron). Sources: CarlesMillan and Rob Lavinsky (Wikimedia Commons, Creative Commons Attribution-Share Alike 3.0 Unported license).

Following Legrand (1980, p. 22) and others, I also believe that Pliny is referring to octahedral crystals, the shape of which was associated in ancient times with invincibility like, for instance the pyramids of Egypt, whose tops point to the so-called "Indestructible" stars (Kochab, star ß-Ursa Minor, the Little Dipper, and Mizar, ζ-Ursa Major, the Big Dipper). The colourless crystals could well be diamonds, which were widely used at the time in their

natural state in many of the rings excavated by archeologists (Figure 120). The coppery *adamas* of Cyprus could be pyrite or perhaps its copper variety or even chalcopyrite, which can form octahedrons of the quadratic type, while the "iron luster" *adamas* could be identified with magnetite (Figure 120).

Black diamonds in Renaissance paintings

Many Western portraits, especially from the 15th to 17th centuries, show some kind of "transparent black diamonds", although the stones epicted are not (see Figure 121). It is a delusion due to the inability of painters, even the best, to understand what they were seeing, i.e., the interaction of light within the gem. These ancient diamond cuts, generally table-shaped with a maximum of a dozen facets, reflect less light in all directions than today's brilliants. Photorealistic simulations (Figure 122) show that, conversely, these tables sporadically reflect large beams of light, like a lighthouse in the night, particularly when the wearer moves with them (Farges, 2014). The effect must have been extraordinary, especially in the evening during candlelit festivities. In addition, optical dispersion splits the light into bright, intense primary colours. Also, the setting often includes a silver paillon placed directly under the gem to enhance its brilliance. It has often darkened over time, creating a strong contrast between the fiery gemstone and its almost black background. The whole effect reinforces the impression of "transparent glass", which artists had trouble conceptualising due to a lack of naturalist knowledge. It wasn't until the 18th century that they understood the phenomenon, and diamonds began to be seen painted as coloured dots on a whiter background. Nowadays, the opposite is happening: for some movies, costume designers use opaque, black gems (often of poor quality!) to reproduce historical paintings. However, they perpetuate the error of the ancient painters, while failing to take into account the enormous rarity (not to say absence) of black diamonds at the time (unlike the colourless ones).

Figure 121 . Left: John de Critz (1551-1642): detail of the portrait of King James I of England and VI of Scotland (Montacute House, National Trust, inv. 2900021); the king wears the hat pin named "The Mirror of Great Britain" with the *Grand Sancy* pendant; right: the *Grand Sancy* diamond, seen from both sides when it was unset in 2018. Note the asymmetry of its faceting and the incredible difference in colour that indicates the obverse and reverse, respectively on the left and right) which is confirmed by the faceting and its wear (mostly scratches) on the surface (the central facet is slightly more at fault on the left as it encroaches on the surrounding facets). Height: 2.7 cm. Photographs: © François Farges (with permission); Paris, Musée du Louvre, inv. OA 10630.

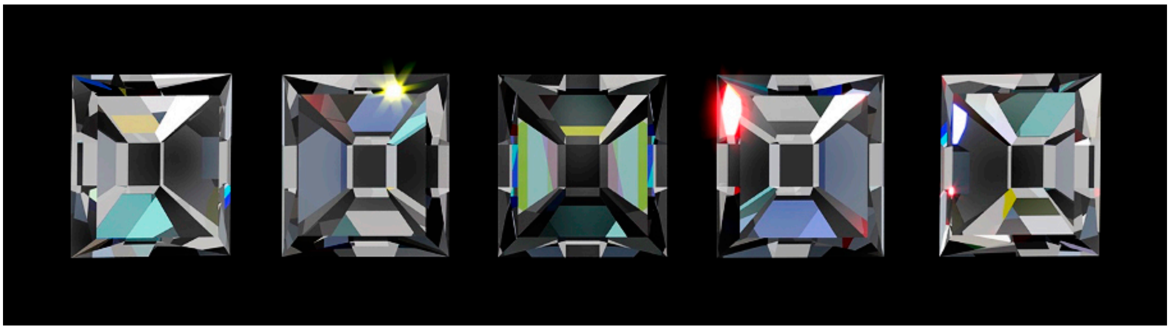


Figure 122 . Simulations of a Renaissance table-cut diamond (15 carats). On the left: mesh of the facets and, on the right, various photorealistic renderings depending on the orientation of the jewel when it was worn.

2. Black diamonds from the Renaissance to the Rococo period

Since the Renaissance onwards, a few extremely rare black diamonds have been sporadically found in certain ancient treasures. For example, the large monstrance, or custode, in the treasury of the cathedral of Santa-Eulalia in Barcelona (Figure 123), the base of which dates back to the 13th century, is said to contain numerous jewels that the faithful added over time. According to Charton (1841, p. 277), the masterpiece included (translated) "a black diamond the size of the Sancy of France, a priceless jewel" later re-described as (translated) "a black diamond of inestimable price, the size of the Sancy of France" (Bosc, 1883, p. 513). This black diamond is therefore a very significant gem at the time, since the Grand Sancy, weighing around 55 carats, was no less than the largest diamond known in Europe at the time (Figure 121, right). Unfortunately, current observation of the object does not allow us to locate this black diamond of around fifty carats, if it still exists.

Figure 123 . The monstrance from Barcelona Cathedral (engraving taken from Charton et al., 1841, p. 276) in the chair of King Martí (Martin I of Aragon; photo (2009) © Bocachete (Wikipedia Commons, public domain; image reworked to make the object stand out)

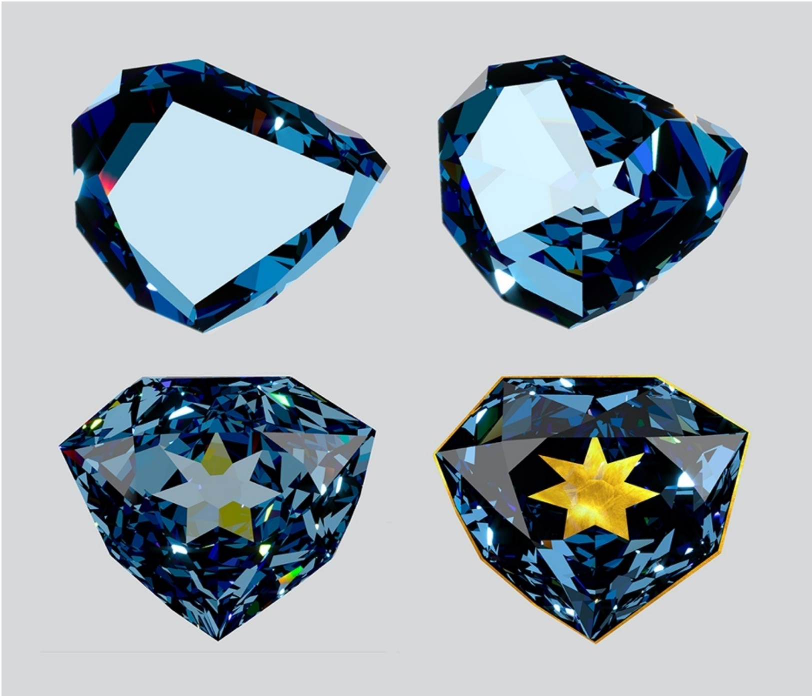


Figure 124 . Tavernier's large blue diamond (approx. 115 carats, approx. 3.2 cm wide) in 1668 (top left), a stage in its recutting (top right) showing the accentuation of its blue colour by brillianting. Below, the finished brilliant of 1670-1672 (69.0 carats) before and after it was set in gold (1672-1673), showing in its centre the illusion of a royal sun, the symbol of Louis XIV. Photorealistic simulations by the author based on an engraving (top left, Tavernier, 1676) and a lead cast found in the Muséum national d'histoire naturelle (inv. 50.165; bottom left). This superb gem, the first large brilliant and by far the most complex in history, was stolen in 1792 and then recut to produce the oval brilliant known as the “Hope”, now in the Smithsonian Institution in Washington. In the meantime, a lead cast was made and donated to the MNHN around 1820 (Farges et al., 2008) to keep a record of his virtuosity, which has since been unequalled.

It was not until the 1660s that brilliant cutting began to flourish under the impetus of Jean Pittan (circa 1617-1676), King Louis XIV's ordinary jeweller. The adjective ”ordinary” here means almost its opposite and requires a little recontextualisation: Pittan, accompanied by his wife Suzanne Lejeune and his son Nicolas, was above all a merchant-mercier and one of the few to receive ordinary royal orders for jewellery, which gave him an exceptional (and envied) status. In fact, he subcontracted royal orders to various craftsmen, lapidaries and jewellers, often in Paris. Although he was not the only one to hold this title, he quickly made a name for himself thanks to his more moderate prices and speed of execution, which we can guess he imposed on his subcontractors. The latter even petitioned the king in 1673 for financial compensation for the extra

work caused by this new brilliant faceting. In vain (Farges, 2020).

This type of faceting is then said to be "*à la mode*" (trendy) in the inventories. It concerned stones weighing just a few carats (Farges, 2014). Between 1670 and 1672, Pittan supervised the recutting of the large blue diamond brought back from India by Tavernier (Figure 124). This gem constitutes the first documented large brilliant in history, quickly followed by various others, such as the Hydrangea-coloured diamond (now known as the Hydrangea, circa 1674), then the Fleur de Pêcher (1683) and, finally and to mention only the most important, the Regent, cut by Joseph Cope in London (circa 1705). Despite this innovation at the end of the seventeenth century, it took painters, even the best, a good half-century to get to grips with the visual effect of brilliance by progressively "whitening" the diamonds they represented (Figure 125), while at the same time punctuating them with multicoloured touches to represent the so-called "fires" of the diamond that existed in earlier faceting techniques (Figure 122).

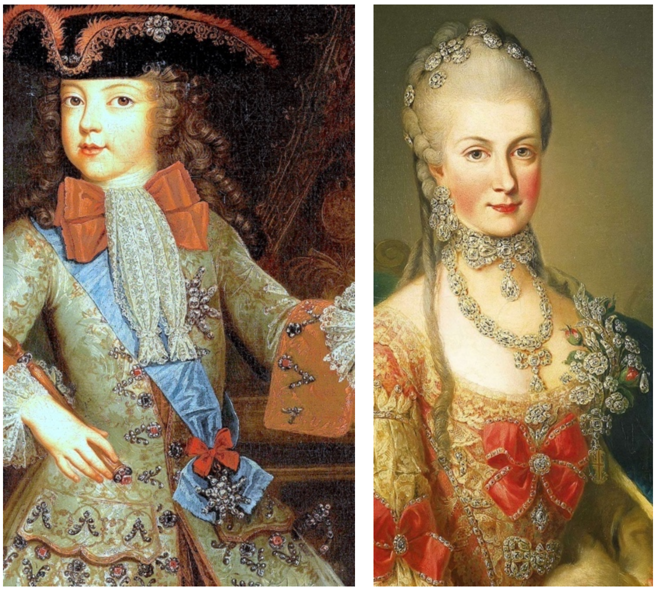


Figure 125 . Left: Augustin Oudart Justinat (1663-1743), portrait of Louis XV as a child (detail, 1717). The monarch is covered in diamonds, which are painted like black glass but whose brilliance is beginning to be understood and materialised by numerous points of white. Right: attributed to Martin van Meytens (1695-1770), portrait of Marie-Christine of Habsburg-Lorraine (detail, circa 1765, Schönbrunn Palace, Austria). Fifty years after the painting on the left, the diamonds and their fires (optical dispersion) are finally depicted as "white" and dotted with colour, respectively. Sources: anonymous via Sotheby's and Yelkrokoyade (Wikimedia Commons, public domain and Creative Commons Attribution-Share Alike 3.0 Unported licence).

3. The rush for fancy diamonds

Although fancy diamonds were highly prized by wealthy collectors when their colour was frank, they were not necessarily highly prized by the European or Indo-Mogol monarchies, where any colour that was too distinctive – such as blue – was long perceived as “feminine”, “ominous” and therefore less prized, according to the emperor Jahângîr (1569-1627) in his autobiographical diary (Jahângîr, 1618; II, p. 38). The colour blue was even considered “disgusting” or “worst of all” by Tavernier (1676) and many Western jewellers. In contrast, Louis XIV publicized them at court after acquiring two large blue diamonds of ca. 115 and 41 carats. From the first part of the 18th century onwards, the powerful of Europe copied this fashion, for examples (Figure 126) the Wittelsbach blue diamond for the kingdom of Bavaria (35.56 carats, shamefully reduced to 31.11 in 2010) or the sublime Dresden Green for the crown of Saxony (40.70 carats).

Figure 126 . On the left, the diamonds (to scale) Blauer Wittelsbacher (35.56 carats, before its recut by Graff in 2010) and Dresdner Grüne (40.70 carats); on the right, the hat hook of the Elector of Saxony (H: 14.2 cm) containing the second diamond (Dresden, *Grunes Gewölbe*). The first appears larger, but is in fact too thin (hence the light colour in the centre); in contrast, the second has excellent proportions. Credits: Physolamuse (Blauer Wittelsbacher, corrected for the over-coloured blue background) – photos by the author.

Many wealthy curiosity seekers began collecting these brightly coloured diamonds in the second half of the 18th century, as these gems offered a vast range of hues covering the entire rainbow of colours. Deeply coloured pinks, incarnates and hyacinths were the most sought-after, as warm colours were those of men expressing their virility (contrary to certain current prejudices). Conversely, women of this period preferred lighter shades of cool colours such as green or blue (which, unlike today, included violet). It was already recognised that bright reds and greens were among the rarest (Dutens, 1777). At the bottom of the scale, blues and blacks were the least valued because, according to Nicolas (1787, p. 204), they were too rare and therefore unavailable to jewellers' customers (each era has its own logic). Later, in the second half of the 19th century, blue and dark colours including green, brown and "jet black" [sic!], were the most discredited by Antwerp merchants (Jacobs and Chatrian, 1884, p. 41), while collectors and gemmologists considered blues and blacks to be superlative colours because of their greater rarity (Barbot, 1858).

It was often men who were "curious about curiosities" who devoted their fortunes to them, such as Alexandre Estienne d'Augny (1715-1798), the Marquis Étienne-Gilbert de Drée (1760-1848) and the Florentine knight Johann Ritter von Baillou (1679-1758), whose collections founded no less than the Vienna Museum of Natural History. They sought out black diamonds for their great rarity, in order to set themselves apart from other collectors and "competitors", as well as from the more client-driven jewellery industry. Conversely, these colourful gems were not intended for jewellery use per se, but they were nevertheless mounted in rings, even large gems weighing several hundred carats. For proof of this, we take a look at the collection of 154 gold rings bequeathed by the Reverend Chauncy Hare Townshend (1798-1868) to London's South Kensington Museum in 1869. The catalogue of this bequest lists as second (out of 154 items) a ring set with a central black diamond approximately 5 mm in diameter and surrounded by 14 small colourless rose-cut diamonds (Church, 1891, p. 101). At that time, rings were considered to be aesthetic pedestals for displaying and handling precious stones, rather than jewellery to be worn. The variety of Townshend's coloured gems, including

apophyllite (!), is far more original and indicative of the collector than the much more abundant and familiar colourless diamond jewellery designed for women at the time. The latter are perceived as “frivolous objects”, because they are relatively similar and relatively easy to acquire if one is extremely wealthy. Moreover, given the quality of this collection, which belonged to a wealthy priest, it is difficult to imagine that it belonged to the 'greats' of his time, such as the Hope Anglo-Dutch bankers or King Louis XVIII of France. The following chapters will provide more details on these figures.

Figure 127 .The Hope (45.52 carats) and the Tiffany (faceted by George F. Kunz, 128.54 carats) diamonds in their historic settings by Cartier and Tiffany and Co. Photos: Wikimedia Commons © Mbalotia (Creative Commons Attribution-Share Alike 3.0 (temperature and colour corrected and cropped) and © Shipguy (Creative Commons Attribution-Share Alike 3.0 Unported licence).

Black and coloured

The highly-respected American historian Robert Proctor (2001) decodes De Beers' 1950s advertising slogans about the "eternity of diamonds" (which, however, can be shattered by a simple shock) and the "*girl's best friend*" engagement solitaire. He shows how the standardisation of the solitaire – a strictly colourless, one-carat, round brilliant cut diamond with 57 facets – has enabled the development of a particular economy – including in Hollywood – where the gem plays the role of a standardised currency, the same for everyone, rejecting any differences in shape or colour. This researcher sees a connection between this commercial diktat and the Apartheid regime then reigning in South Africa. Coloured diamonds, known as *fancy diamonds*, were long depreciated, except by Louis XIV and in the United States of America where, for example, Hope and Tiffany diamonds (Figure 127) found their way into the market. Today, diamonds in the brightest colours, especially reds, pinks and blues, fetch stratospheric prices. However, black diamonds, although now commonly faceted, are often scorned or have a sort of "alternative counter-fashion". According to Proctor, the majority of buyers stick to gems that are more classic and simpler to apprehend, such as the solitaire, because they still retain a strong symbolic power, linked to a sense of belonging. A similar phenomenon can be observed with spinel: long considered to be second only to ruby, or even its equivalent in the Middle Ages, its black variants were discarded in the mines of Thailand, where they are now being re-used to facet gems of all shapes and sizes. Finally, Proctor contrasts the diamond with the agate, the queen of gems under the Romans, which has since been trivialised, even though each is unique and therefore more original. Nevertheless, it requires a personal effort of appreciation, which a more stereotyped gem does not require. For this historian, there is nothing more precious and rarer than an agate, which seems "obvious" to any mineralogist. But it had to be said and, above all, decoded.

4. From Tavernier to Dupleix

While Parisian workshops, particularly those run by Protestants, were perfecting diamond cutting for the Sun King and his successors, their Indian counterparts were bringing back vital information about black diamonds.

To my knowledge, Jean (Baptiste) Tavernier seems to be the one who first spoke of black diamonds, but, like the other colours, he discredited all fancy diamonds, including black ones (translated): "And it should be noted that, just as at the Visapour mine, the stones in this one depend on the quality of the soil in which they are found, so that if the soil is marshy and damp, the stone turns black; if it is reddish, the stone turns red, especially as the soil varies from the village to the mountain." He goes on to give two examples where black diamonds were found: at the famous Gani (or Kollur) mine and in six mines in the province of Carnatica, which were closed because they produced stones that (translated) "were all black or yellow, & there was not one of good water" (Tavernier, 1676, II, p. 306). These writings by Tavernier are the earliest I know of that mention black diamonds. They certainly date back to 1643, when Tavernier visited the Gani mines during his second voyage to the Orient (Persia-India, 1638-1643), including those at Golkonda. This information was plagiarised and published by his first writer Samuel Chappuzeau (1615-1701), without Tavernier's knowledge, during his sixth voyage (1664-1668) to India (Chappuzeau, 1665, p. 14). They were not officially published by their author until ten years later (Tavernier, 1676, II, p. 305). In addition, Gruosi (1999) mentions a writing on black diamonds by Chappuzeau dated 1671 (but I was not able to identify this source that seems inexistant but the original 1665 one).

Another testimony, almost unknown today, is dated June 1755. The former Governor of Pondicherry (or Puducherry) and Commander General of the French establishments in India, Joseph François Dupleix (1697-1763), arrived in Lorient (Brittany) on his return from India, deposed by King Louis XV as a disastrous prelude to the catastrophic conditions of the Seven Years' War (1756-1763) against Great Britain. He was accompanied by his wife,

Jeanne Albert de Castro (1706-1756), an Indo-Portuguese from Goa, then a Portuguese trading post. *Madame Dupleix* was above all multilingual, beautiful, impetuous, smart and wealthy (Figure 128). Nicknamed *Joana Begum*, suggesting both her character and her many connections with the local Rajahs and other Indian aristocrats, she was famous for her verbal antics. She dressed in Oriental style and covered herself in ad-hoc jewellery (Gaebelé, 1934). When they disembarked in Brittany, the Dupleixes asked for some assistance from the Maréchaussée (the French royal police at the time) to (translated) "guard her jewels; his wife has a set of black diamonds that are priceless", as the Marquis René Louis de Voyer de Paulmy d'Argenson (1694-1757) wrote in his Mémoires (Argenson, 1755, p. 28).

Figure 128 . Joana Begum, the "Marquise Dupleix" and her husband, Joseph François Dupleix. Source: Gaebelé (1934), Figure 2.

5. The Bapst Maison

But above all, there were the Bapsts, the most breathtaking dynasty of jewellers in the French capital, about whom I have highlighted in this book important facts about black diamonds that have since been largely forgotten.

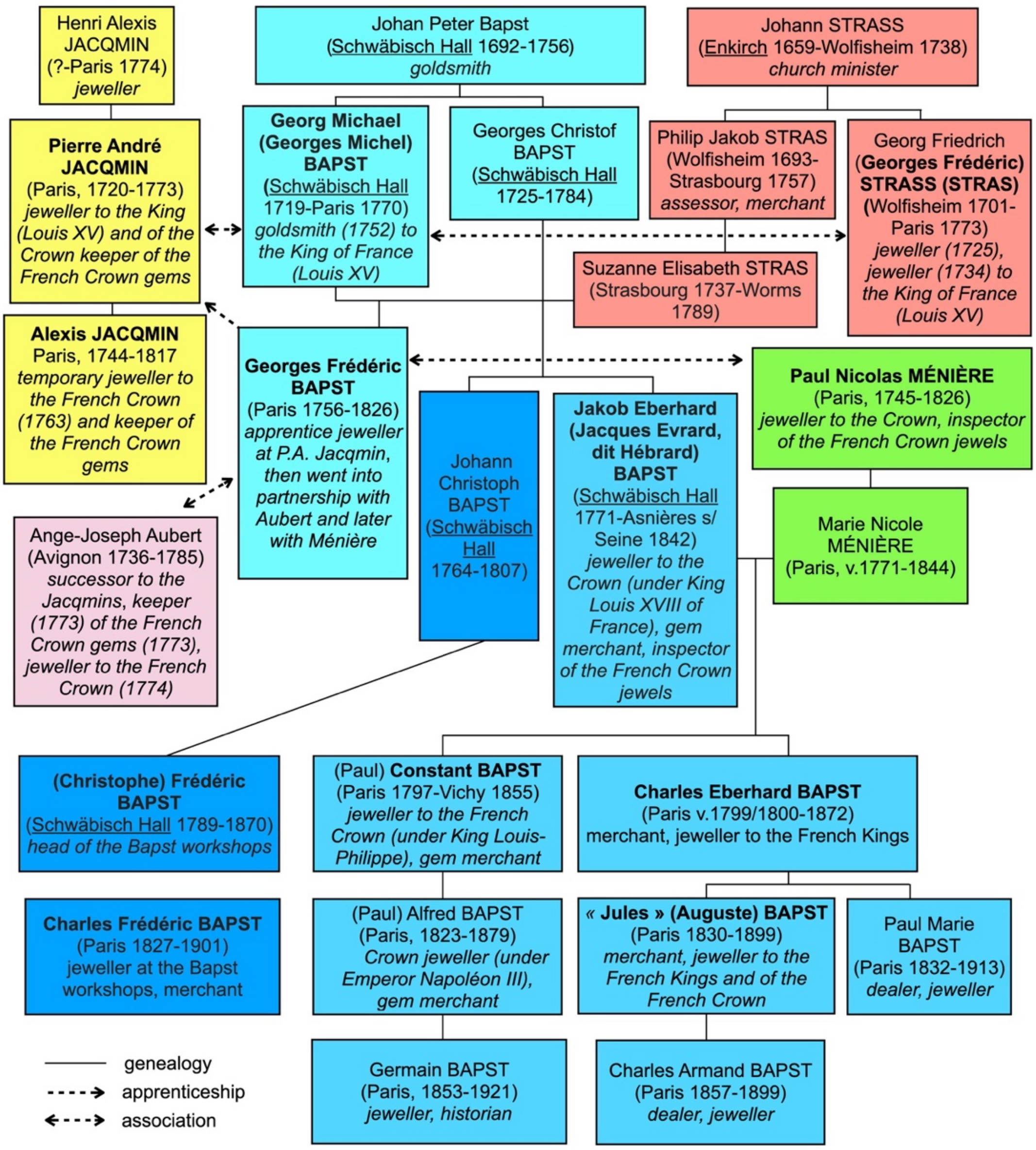


Figure 129 . Family trees of various jeweller families from the different crowns of France in the 18th and 19th centuries (excluding the First Empire) mentioned in this book (in bold). Compiled using the pierfit collaborative genealogy database (Geneanet) and various archives, including the *Minutier des notaires* at the Archives nationales (Paris). Foreign locations (Moselle and Swabian) are underlined. The three waves of Bapst immigration from Germany are shown in shades of blue (light, medium and dark). The dotted arrows highlight professional collaborations, other than matrimonial ones.

Figure 130. Two generations of the Bapst dynasty in France: on the left, 'Mr Bapst' (possibly Georges Frédéric, 1756-1826), drawn and engraved by Edmé Quenedey between 1786 and 1830 (Paris, Paris Musées / Carnavalet Museum – History of Paris, inv. G.20815-21); on the right: Jules Bapst (1830-1899), photographed by Nadar before 1899 (Paris, BnF, Gallica/Prints and Photography, inv. FT 4-NA-235 (2)).

The Bapsts were jewellers who immigrated to Paris from Schwäbisch Hall (Baden-Württemberg, Germany) in the 18th century (Bapst, 1889). They form one of the most breathtaking dynasties of jewellers in the French capital. They took over the legacy of the Crown jewellers under Louis XV, which had been left vacant by the son of Pierre André Jacqmin, Alexis, who renounced the position and title of Crown jeweller awarded in 1763. The Bapsts came to France on two occasions: the first being Georg Michael (francized Georges Michel) Bapst (1719-1770), who married the niece of Georges Frédéric Strass, already established as a jeweller in Strasbourg by 1725 (Haug, 1961), which led the Bapst's Maison to claim that it was "founded in 1725". Their son Georges Frédéric (1756-1826) was apprenticed to Pierre André Jacqmin, probably alongside with Alexis. But that was as far as the jewellery business went. Meanwhile, Georges Frédéric brought to Paris his cousin Jacob Eberhard (Jacques Evrard) Bapst (1771-1842), who married Marie Nicole Ménière (c. 1771-1844), daughter of Paul Nicolas Ménière (1745-1826), Crown jeweller and inspector of Crown diamonds (Figure 129). In the 19th century, this prestigious Parisian jeweller's shop continued to develop and reached its

apogee, serving the Ancien Régime, the Restoration and the Second Empire, with the notable exception of the First Empire (Morel, 1988).

Figure 131 . Anonymous: Louis XVIII of France (1814-1824). Private collection. This mineral-loving king tried in vain to acquire the Bapst's Diamant Noir for the French Crown. Credit: Marie-Lan Nguyen/Wikimedia Commons.

6. The "*Diamant Noir*" or the "Stone of Affection" of the Bapsts

I am privileged to be able to describe this 'Bapst stone' in detail for the first time since the 19th century. Gruosi (1999, p. 60) had mentioned it briefly, but unfortunately incorrectly, according to Dieulafait (1871, p. 106), who himself was mistaken. It is therefore my duty to correct it: this incredible story is corrected here, in spite of the limited documentation available at the time. However, the accounts have been cross-checked to provide the most plausible narrative to date.

The Bapsts had a ring in their personal collection that they did not want to sell: it was set at its centre with the largest black diamond known at the time, said to be (translated) "of prodigious size" (Nogues, 1868). The French physicist Jacques Babinet (1855), here he is again, saw this diamond (translated) "a very long time ago" (in 1855) and described it as having "the bistre hue of tobacco juice, and was recommended only for its singularity. Louis XVIII had selected it for the crown at a price of 24,000 fr. but it had not been delivered. He adds that this diamond was the Bapsts' "Stone of Affection" and that they would not part with this "prodigal son" for anything in the world. They also called it "*Diamant Noir*" (Black Diamond), a practice that was still rare at the time for a diamond that was not aristocratic and so not historical.

Clearly, the Bapsts' attraction to this black diamond, which was so little inclined towards optics, was not shared by the physicist-optician, who, logically, swore by transparent diamonds. However, King Louis XVIII (1755-1824; Figure 131) was an "eminent mineralogist" thanks to the expertise of Jacques-Louis, comte de Bournon (1751-1824). De Bournon collected all the rarities of the mineral world in His Majesty's cabinet of mineralogy, still kept at the Muséum national d'histoire naturelle in Paris. Alas! his collection contains no black diamonds, but dozens of other colours, often pale-to-colourless. This testifies to the rarity of these specimens at that time, even for a king with a comfortable civil list that he used for his lavish purchases.

In addition, his informal collection of gems, apart from his private mineralogy cabinet, included the Mazarin II diamond and the Côte-de-

Bretagne spinel, which he repurchased during his reign after they had been stolen in September 1792 from the Hôtel du Garde-Meuble in Paris (purchased from his civil list, he bequeathed them to the Crown on his death).

The Bapst's *Diamant Noir* was extremely rare, an exceptional piece for these jewellers who had held and set so many exceptional diamonds with their hands. We would have liked Babinet, as a scientist, to tell us about it in more rigorous terms (dimensions, shape, faceting, weight, etc.) because he gives us just as little information as journalists like Nogues (1868). I confess that I have not found anything more factual about this gem set in a ring: to my knowledge, there are no photographs, engravings or drawings of this jewel. It is certainly too atypical for many of its contemporaries, even though it was exhibited at the Paris World Fairs of 1855 and 1867, right next to the Grand Sancy diamond (Figure 121, right), which belonged to the Indian businessman Jamsetjee Jejeebhoy (1783-1859). Jejeebhoy had obviously loaned it to the Bapsts for the occasion (in 1855, although the Bapsts inherited it in 1867). The Bapsts were so proud of it that they showed their *Diamant Noir* to the Duke and Duchess of Brabant (Crown Prince Leopold Louis-Philippe Marie Victor of Saxe-Coburg-Gotha and Marie-Henriette of Habsburg-Lorraine), stressing that it was one of the “rarities of the Exhibition” (George, 1855). It was even described as “the most beautiful in the whole world”, brilliant-cut and “despite its dark colour, it is perfectly transparent and plays in the light in a marvellous way” (Nogues, 1868). Unfortunately, the Bapst archives at the BnF make no mention of it.

Its price remains the only available indication of its dimensions. The Tavernier (1676) chart of diamond prices, based on the square of the weight, was still used in the 19th century. A weight of around 15 carats is calculated on the basis of a price of 112 francs per carat for a collector's diamond (Lançon, 1830, p. 47). This is a far cry from the “prodigious size” redicted by those who saw it throughout the 19th century. At his exhibition at the Champ-de-Mars in Paris in 1867, Lacroix (1867) fortunately indicated that the price of a black diamond must be calculated another way, in proportion to its weight. If this method of calculation was applied by the Bapsts, this 24,000-franc diamond must have weighed – approximately – around 200 carats. The *Diamant Noir* would therefore be a gem of about 3.5 centimetres in average dimensions with

a stocky shape – like the Great Mughal diamond, for example (Figure 7) – to be set in a ring (like the gigantic aquamarine in the Townshend collection at the V&A museum in London).

Charles Barbot curiously describes this black diamond as "cut very thin, and yet its superficial brilliance was very vivid. This diamond came from the Dogni collection". But, in contrast, diamond dealer Caire-Morand (1826) states that "M. Lorentz, a jeweller in Paris, owns a beautiful black diamond from the Dogny collection". Between Caire-Morand and Barbot, who is right? I have already shown that Barbot was mistaken about the provenance of various gems (Farges *et al*, 2015), as were many jewellers (and mineralogists). This "Dogni" or "Dogny" is the "revolutionary" surname attributed to Claude-Jean Rigoley (1725-1798), Baron d'Ogny, who is often confused with his compatriot "Daugny", i.e., Alexandre Estienne d'Augny, the great collector of coloured diamonds already mentioned above, who actually owned a black diamond (Dutens, 1777). The former, who was related to Voltaire, was intendant general of the Post Office from 1770 to 1791 and therefore close to the French King Louis XVI. However, he is not known to have any great expertise in the field, other than covering his many amorous conquests in jewels. In 1785, however, a certain Dogny co-expertised the famous Boehmer and Bassange jewel with a man called Maillard, before the Cardinal de Rohan interfered at his expense in the affair of Queen Marie-Antoinette's necklace (by the way, certainly composed mainly of Brazilian diamonds; Figure 70).

It is therefore possible that the aforementioned "Dogni" or "Dogny" is, in fact, the aristocrat d'Augny. Furthermore, according to La Tynna's imperial almanacs of 1809-1811, the jeweller Lorentz was based at 32 quai des Orfèvres in Paris (where a building of the Paris courthouse now stands, whereas the Bapsts were at 30 quai de l'École, the present-day quai du Louvre, downtown Paris). Moreover, Augny only owned gems of lesser weight and price (Dutens, 1777). At the time of the sale of the collection of the late Augny (then Daugny) in 1798 – from which the Marquis de Drée bought many fancy diamonds – Augny's black diamond was no longer to be found, as it had obviously been acquired by Lorentz. I also doubt that the Bapsts kept a diamond that was both superb and "thin", which would be inconsistent with a ring setting. In addition,

it would be so large (over 10 cm in average diameter!) that it could not fit on any ring. Finally, this version is contrary to that of the Bapsts, who were one of the greatest aristocratic families of the time, as we shall now see.

7. “Experts” blending truth and fantasy

The story of the Bapst’s *Diamant Noir*, or at least what we know of it today based on hearsay from journalists then and now, is even more fascinating, paradoxical as it may seem. The journalist Jules Lecomte (1863) recounts this tale – not so long forgotten – but which is essential for the next section of this chapter (translated): “Towards the end of the last century, a French soldier in the Pondicherry garrison, knowing that two magnificent black diamonds formed the eyes of the god Brama in the temple, conceived the plan to seize them. He deserted, embraced the religion of the Brames, and feigned the zeal of this belief so well that he was admitted to guard the sacred place. One night, he had already succeeded in plucking out one of the idol's eyes, when he was stopped by an obstacle at the moment of seizing the second. The god Brama thus eborbised, the false priest fled and reached the English establishments, where he sold his prey, the origin of which he concealed, as you would expect, to an English general for 3,000 pounds sterling. This general was Lord Hamilton's great-uncle, and this is how the truly precious stone ended up in the multicoloured collection of the person mentioned, one of the allies of His Majesty the Emperor. The beginning of this fable is almost identical to the one that has been told about the Orlov diamond since Dutens (1777).

The following is more solid than the Indian story. This “Lord Hamilton” did exist (Figure 132): he was Alexander Hamilton, 10th Duke of Hamilton (1767-1852), a great art collector and, indeed, a fervent admirer of Napoleon I. I have not identified the great-uncle mentioned, other than his great-great-uncle, George Hamilton (1666-1737), who was a general and even the first British *field marshal*. Lord Hamilton owned a case containing a set of twelve rings, each set with a coloured diamond. The journalist Barrière, who got this information directly from the Bapsts at the Paris *Exposition Universelle* in 1855, reports that the set was described as an "immortal rainbow" (Barrière, 1855). He adds that the case was acquired around 1818 (1819 according to other sources) by the Bapsts, probably by the eldest sibling, Jacques-Evrard (1771-1842). The jewels in this unique collection were resold: the pink diamond went first, quickly followed by the blue diamond and the eight others. Babinet (1857)

confirms this version and even add that the Bapsts kept the black diamond, which the “Bapst son” (Constant, 1797-1853 or, more likely, Charles Eberhard, 1799-1872, who was the only one alive when Babinet wrote) then continued to refuse to sell, preferring to pay the annual annuity of 1,500 francs to Hamilton when the gem was valued at “only 30,000 francs” at most (others even reported a value up to 40,000 francs).

Figure 132 . Henry Raeburn (1756-1823) : Alexander Hamilton (1767-1852), 10th Duke of Hamilton and 7th Duke of Brandon. Lennoxlove House, East Lothian. Photo: Christie's, # 5471484; source: Wikimedia Commons (full portrait and detail; note the similarities in dress to the Figure 131).

8. The black diamond fashion is on

In the meantime, let us examine Barbot (1858), who reports another direct testimony (credible this time) in his chapter on carbon: "Mr Chabaribert, a diamond merchant in Brazil, at whose house we saw a piece of carbon weighing more than 1000 carats, possessed one of about 6 carats, almost crystallised; he presented it to the skilful diamond-maker, Mr Philippe the Elder, who made him a superb black diamond, reflecting the light perfectly by the polish of its facets, although it was completely opaque and seemed adventurous by the extreme quantity of these white points of which it was composed. Philippe the Elder, who made him a superb black diamond, perfectly reflecting the light from the polished facets, even though it was completely opaque and appeared to be adventurous due to the extreme quantity of white dots we have just been talking about. The "white dots" are these bursts of bright, intense light due to the high refractive index of this substance, which shimmers in the light in the same way as, though much less intensely than, the mordanted flakes of mica in quartz, and which was then known as aventurine (we had already mentioned François Alban Chabaribère as a French trader who emigrated to Brazil and was naturalised there). The moral of this fairy-tale-like story is particularly noteworthy: the material is called "a piece of carbon" in its natural ("rough") state, but becomes "a superb black diamond" when faceted by the bewitching touch of an expert diamond cutter. In a nutshell, a supposedly beautiful beast: this marketing credo is as strong as ever.

But I was (almost) saving the best for last in this section: this first large faceted black diamond in history (to my knowledge) was neither Indian nor even from Golkonda. In fact, according to George (1855) who get the information straight from the Bapsts, it actually came from Brazil, i.e., probably Minas Gerais during the second quarter of the 18th century. Be that as it may, following the example of the Dukes of Hamilton and Louis XVIII, the Bapsts understood the mineralogical and gemmological interest of black diamonds, thanks to their uniqueness at the time, but also because of the difficulty of faceting them (they had to be monocrystalline black diamonds, not

carbonado). In short, the great aristocratic collections inspired innovation and fashion, following the example of Louis XIV and his French Blue Diamond. However, Louis XVIII failed with the Bapsts to acquire the Diamant Noir for the benefit of the French Crown. This would have provided more tangible information about this obviously fabulous gem, which all diamond experts since 1870 have ignored and which resurfaces here in some details. The Bapsts had difficulty surviving after the fall of the Second Empire and their Maison expired for good in 1930. What became of this Brazilian black diamond of prodigious dimensions and cloaked in a Hindu legend after 1930? Find out in later chapters...

Figure 133 . Four renowned collectors of black clothes and diamonds: (left to right) Alois I von Liechtenstein (by Peter E. Stroehling 1794, Vienna, Liechtenstein Museum); Arthur Wellesley / Wellington (Thomas Lawrence, circa 1821, London, National. Portrait Gallery; Henry Philip Hope (Thomas Goff Lupton Bouton, 1823, London, National. Portrait Gallery); Charles II of Brunswick (unknown artist, circa 1825, location unknown). Sources: Wikimedia Commons.

Other examples could be cited, as the description of the Bapst's Diamant Noir as "the most beautiful in the whole world" confirms that there were other diamonds of this type, albeit necessarily less imposing. Among them were the black diamonds of the Marquis of Drée and the Prince of "Licthinstein" (Caire-Morand, 1826), i.e., the Princes of Liechtenstein – who may have been Joseph-Wenceslas (1696-1772), and/or Franz-Joseph I (1726-1781), and/or Alois I (1759-1805) – who assembled one of the richest private art collections in the world in Vienna (Figure 133). On the English side, the Duke of Hamilton was not alone in his infatuation with black diamonds: Streeter (1879, p. 119) informs us that Arthur Wellesley (1769-1852), the famous First Duke of Wellington, owned one that is described as "unwonted", "very fine", weighing 12.5 karats (about 12.83 carats) and valued at no less than £183 (and 15 shillings) in 1869. According to Paxton (1856, p. 17), the Duke of York's diamond was "of great size and beauty", but here too it is impossible to know more about the diamond and the Duke: was it Frederic of York (1763-1827)? Of course, I forget Henry Philip Hope (1774-1839) who also owned his black diamond, albeit a small one at 1.35 carats currently on display in the spectacular Townshend bequest at the V&A in London (inv. 1173-1869) (Figure 134).

Figure 134 . One of the few, if not the only, surviving 19th-century black diamond ring: that of H.-P. Hope and later the Reverend Chauncy Hare Townshend (1798-1868). Low-resolution images (under the terms of the licence, < 860 pix): © Victoria and Albert Museum, London (inv. 1173-1869).

Black and White, from Taoism to Reformation

The history of black diamonds is astonishing. This gem, which has left the conventional jewellery circuits, has found its way into the hands of private collectors, who often combine them with other colourless or white gems, such as diamonds and pearls, as in the Chinese symbolism of the ying and yang of Taoism. In the 1930s, the merchant J.W. Paris – said to have owned the Black Orlov black diamond – was more a specialist in fine pearls than diamonds. Later, Fawaz Gruosi (1999) emphasised the diamond/pearl duality in his contemporary jewels, where one is either black or white (or colourless). Eaton-Magaña *et al* (2019) have studied white diamonds against blacks including the Black Orlov as an illustration.

The most significant encounter was, in my opinion, that of the Bapsts, who exhibited their Black Diamond on two occasions (in 1855 and 1867) with the Great Sancy, then on loan from the Jejeebhoy family, who owned it. This diamond, richly faceted in double rose, of fabulous aristocratic provenance and imported at great expense from India, served to sacralise the Black Diamond, which represents everything it is not in terms of curiosity, Parisianity and new beauty: a history freed from a past, a refreshing novelty, the very vision of the future. Unfortunately, no illustrations of this crossroads have been found.

It is not the colourless diamond of the old monarchs adorned in moiré satins and twirling lace, but a gem with which these aristocrats dressed in the black martial uniforms of the men of power of a military-scientific century became infatuated. This fashion, like that for Louis XIV's Great Blue Diamond two centuries earlier, which highlighted a hue that had previously been considered "disgusting" [sic!] by the experts of the day (Tavernier, 1676), shows the extent to which the Bapsts were both visionaries and experts in truly exceptional gems, even though they sold hundreds of colourless great brilliants "à la mode" without being moved by this "Stone of Affection" – the Diamant Noir – over four generations, i.e., some 110 years. This complementarity can be seen in their supply of white and black pearls to Empress Eugénie. For these Bapsts of Germano-Protestant origin, it seems to me that the first is a traditionalist and spectacular expression, in the image of Abbé Suger with the luminous Gothic style, while the second expresses the deep interior, perhaps that of a more verist Reformation.

Half a century later, there were those of the Duke of Brunswick, Charles II (1804-1873), including one of 345 carats, reputed to be uncut according to Le Monde illustré (no. 191 of 1860) and a large black brilliant (no indication of weight) mounted on a pin (#203, post-death sale catalogue, Geneva, 1874, p. 19). Count Xavier Branicki of Poland was not to be outdone, with another black diamond in his large collection of gems, including an enormous sapphire weighing 292 carats (Farges, 2015), which, according to the *Messager de l'Exposition* (I, p. 5) was exhibited by the jeweller Rouvenat at the 1878 Paris Universal Exhibition. In short, every great aristocrat of the 19th century, including a number of great military men, was infatuated with black diamonds, mostly mounted in rings not as jewels in themselves, but as displays.

According to Babinet (1857), the Portuguese crown also had black diamonds set for its mourning jewels, possibly during the funeral of Queen D. Maria II in 1853. In this particularly tragic case, the sovereign was only 34 years old, so real black diamonds may have been used.

Even French diplomats scrutinised them closely: the French *Journal officiel de la République française* (No. 273 of 29 September 1874, p. 6763) reported the arrival of a stone that looked rather modest among its diplomatic returns from southern Africa, where (translated) “A black diamond weighing 10 carats has been discovered. It is believed to be of extraordinary value due to its extremely rare colour”. Taken together, these reports speak volumes about the attraction of black diamonds at the time, when South Africa was beginning to flood the jewellery markets with a flood of gem diamonds, the largest of which – over a hundred carats – did not attract the attention of government diplomats, unlike a black diamond weighing “only” 10 carats.

9. Even in high jewellery

Have I forgotten to mention the *American Queen of Diamonds*? The one that some jewellery journalists have neglected, talking mainly about Barbra Hutton and Evalyn Walsh McLean? But they were preceded by the woman who contributed to the jewellery glory of Tiffany and Co. I am talking about Mrs Leland Stanford, Jane Elizabeth Lathrop Stanford (1828-1905; Figure 135 on the left), who in 1876 was presented by her husband Leland Stanford with the "*Riviera demi-parure*", the first set of fine jewellery ever made in the United States. The *Queen* adorned herself in the finery of Isabella of Spain and Eugénie de Montijo, including her six strands of pearls, all supplied by Tiffany and Co. According to Stephen Birmingham (2024), she was surpassed only by Queen Victoria and Tsarina Catherine the Great. Incredibly, the same author reports that she once wore her entire collection to a private dinner given by William E. Dodge, choosing a black dress with voluminous pleats on which all her little ornaments could be pinned and hung. In addition to her sixty pairs of top-quality earrings, Jane Stanford also owned the most beautiful and richest fancy diamond necklace in the United States. And also a large pear-shaped black diamond... (Birmingham, 2024).

Around 1897, the widow Stanford decided to sell her collection in order to finance the "Jewel Fund", which was used to enrich the library that she and her husband sponsored at Stanford University, or more precisely, the Leland Stanford Jr. University, of which I was a professor until recently, which they founded in memory of their son who died of typhoid in 1884 at the age of 15. A painting representing a tiny part of his enormous collection was commissioned and can still be admired in the university's Cantor Museum (but the black diamond cannot be identified if the jewel was eventually painted).

In 1904, Cartier sold a pendant set with a black diamond to Count Vincenzo Florio, Jr (1883-1959; Figure 135 on the right), an Italian entrepreneur and sports patron (Nadelhoffer, 1984, p. 306). For the Count, an enthusiast of racing and sports cars, which were the new steeds of the aristocracy of the time, Cartier took up the codes of the masculine aristocracy from the 19th century (the supposedly non-frivolous one). In fact, many of the

great Parisian, American and other jewellery Maisons have worked with black diamonds, although some still ostracize them with incomprehensible vehemence. Of course, naturally large and untreated black diamonds are much less common in the showcases of these Maisons than their colourless counterparts. Not the demand, but the supply, because they are so rare, just like in the 19th century. Some of the great names of these great houses have even told me on the sly that they have unofficially acquired some for personal use, including as an upmarket gift for their relatives, so fascinated were they by their beauty.

Figure 135. Jane Stanford (before 1905; wearing the six strands necklace of fine pearls from Eugénie de Montijo) and Vincenzo Florio junior (vers 1905). Sources : Wikimedia Commons/archive.org.

10. Haute couture and opera

On the other hand, women were trying hard to impose the image of a person who is trying, as far as possible, to take responsibility for herself and break free from these societal shackles, but who has since been forgotten. In other words, the black diamond was the ally of some women who dared to assert themselves. Their supporters were, as is often the case, innovative artists. Black diamonds made the headlines in the "women's press" (a horrible expression) at the end of the 19th century.

The magazine "La Grande dame", known as "de l'élégance et des arts", published on the 1st January of 1895 (no. 25, p. 12), carried three articles by a woman called "Zibeline", who mentioned the fashion of the day when ladies would wear a (all are translated) "corselet of breitschewanse [sic!breitschwan(t)z, a variety of astrakhan fur], inlaid with guipure and studded with jet and black diamonds, closing the front of the dress..." then (p. 85) "a rain of jet held to a yoke entirely embroidered with jet and black diamonds mixed with sequins". Finally, she celebrates the creations of the British-born Parisian couturier Charles Frederick Worth (1825-1895 ; Figure 136), one of the founders of Parisian haute couture and the concept of the Maison (pp. 274 à 275) : "to Worth for having first given the signal for this return to art in adornment and in women's clothing..." by creating "... jackets of the purest Louis XV style with pockets and facings adorned with artistic buttons in chased gold, black diamonds or rhinestones, with mixtures of pearls and precious stones... For the morning, we have the gentle toquet in braided chenille and felt, adorned with velvet held in place by a black diamond motif with aigrette feathers ... For the afternoon, it is the large Louis XVI hat in velvet adorned with feathers, or the Colombine headdress draped in royal blue velvet with a background inlaid with old silver and black diamonds, enhanced with applied lace and a marabou aigrette". This combination of black diamonds and rhinestones suggests that the former are natural stones (and not embroidery supplies) and the latter artificial accessories (author's note: I presume that the "Colombine hairstyle" refers to the "*à la Fontanges*" one that was so fashionable in Versailles during the Grand Siècle).

Figure 136 . Charles Frederick Worth and two of his models: ensemble (1895) with silk, fur, linen, (embroidery) pearls, (fake) diamonds and jet (New York, Metropolitain Museum of Arts, inv. 2009.300.617a-c); the Marquise Luisa Casati (1881-1957), Worth's muse, model, patron and socialite, in a “Queen of the Night” costume embroidered with diamonds (tiara and stars, visibly colourless and black) and co-created with Léon Bakst (1866-1924; anonymous photograph, 1922). Sources: Wikimedia Commons.

Although the author Zibeline (whom I have not identified) differentiates black diamonds from the rhinestones used in haute couture embroidery supplies, in this case we may be talking about faux black diamonds or rhinestones or jet etc... Nevertheless, the optical effect of black diamonds, whether real or fake, was incorporated into Worth's fashion designs – very much in the style of the time – as a totally integrated, even traditional, stylistic element at the end of the century, when the bourgeoise became the dazzling adornment for her austerely black-clad husband. As for jewellery, the fashion journalist known as “Viviane” explains in her column entitled “*Le cadran de la mode*” (La Fronde, 3 September 1901, p. 2) how (translated) “we will *endiamonding* ourselves this winter” (1901). She explains (translated) “An emerald, a ruby, a sapphire, simply set in gold or brilliants will carry a simple splendour far superior to any complicated composition presented under the name of jewels” then “The black diamond, the pink pearl, the emerald will be very popular. The opal much less so...” (!) Who dared say that jewellery was not frivolous (to our great delight)?

Not to mention racehorses and other truffles known as "black diamonds"... Not to be outdone, plays, novels and comic strips all use the literary concept of the "black diamond" as a fertile oxymoron which, like a black star or sun, is built around a diamond that is in fact classically viewed as a round colourless brilliant. But this literary device, worn to a fine pulp over the last two centuries, is still used to describe a pair of dark, vivid eyes, almost always those of an exotically desirable woman, perhaps poisonous, of necessity. The whole thing is wrapped up in plots and mysteries of varying degrees of sophistication that form the backdrop to numerous works of fantasy, even bordering on the occult, which, curiously enough, have inspired the cinema less than the written word. This trend has resurfaced as a counterpoint to the thrills and spills of the jaded upper middle classes of the 19th century, who were so fond of spiritualism even though these two eras – past and present – are perceived by non-scientists as too oppressive because of their technological complexity (from the arrival of electricity to the rise of artificial intelligence).


Figure 137 . The opera Bacchus by Jules Massenet and Catelle Mendès at the Théatre national de l'Opéra in Paris in 1909: on the left, the scene from Act 1, "Les enfers" (The Hells), and, on the right, the official photograph of Renée Parny as Perséphone in Act IV (the one from Act I with the crown of black diamonds was obviously not immortalised). From the periodic "Le théâtre", 15 July 1909 (pp. 9 and 10). Source: Gallica/BnF.

Opera, of course, was infatuated with them. For example, the French artist Émile Joseph Porphyre Pinchon (1871-1953), alias Joseph Pinchon, famous among the French for his comic strip Bécassine, costumed the

performers in Bacchus by Jules Massenet (1842-1912). Written to a libretto by Catulle Mendès (1841-1909), this opera, considered innovative at the time, was premiered at the Opéra Garnier in Paris in May 1909. The actress (not a singer) Renée Parny wore a "crown of black diamonds" (Gauthier-Villars, 1908) for her role as Persephone in the first act, which which was set in the Underworld (Figure 137 left). But alas, her official photograph shows her in Act IV, not Act I (Figure 137 right). Unfortunately, despite two requests, I was unable to gain access to the jewellery collections of the Paris Opera to analyse any gems. As in haute couture, the probably fictitious nature of the black diamonds - for me, probably embroidery material - does not detract from their aesthetic sanctity. On the contrary, they support the wild drama unfolding inside this Styx.

More recently, Jeanne Lanvin created a highly symbolic "Diamant noir" dress for the summer of 1938 (still kept in Paris, Palais Galliera, inv. 1985.1.226). In 2004, the magazine "Le Spectacle du Monde" (501, p. 84) reported that the Maison Cartier, here it comes again, (translated) "put the expertise of its teams to the test with the creation of a (translated) "mysterious clock with two panthers" staring like prey at a rough black diamond weighing 97.14 carats, all resting on a rock crystal surrounded by numerals made up of 2,479 brilliants. A century after the sale of a black diamond pendant to Count Vincenzo Florio, Jr., the Maison Cartier renews its inspiration with a large black diamond, this time in its natural state, perfectly presaging the course of events seeking more naturality. Here again, this mysterious clock again combines the solar opacity of a black diamond with the icy, celestial colourlessness of rock crystal. We could also mention their watches (Santos) or those of Chaumet (Class One) or the contemporary jewellery of Chanel (the Camélia ring for instance), Graff, Armani or Jar, to name but a few of the well-known brands recently offered by Sotheby's or Christie's. I'll stop here, but this list could be enriched by a closer look at other European countries and even beyond, as *Begum Joana* and Dupleix taught us. In short, beyond the denials (in truth, the impotence and even incompetence), the black diamond in natural majesty has made its mark with the greatest designers.

Gems *that* Work for a Living

Black Diamonds, the Most Precious Stones on Earth, Put to Curious Industrial Uses

By ORVILLE H. KNEEN

ON YOUR mountain hikes some day you may come to a dry creek bed showing bits of gray granite, sparkling quartzite, or pieces of conglomerate, rounded stones set firmly in natural cement. You may spy a dark

Just such a "black diamond" was picked up by a naked black miner in Brazil some thirty-two years ago, and even at the low prices of that day it

brilliant branch of the family. Like the gems, they are ninety-eight and a half percent or more pure carbon. But there is this vital difference: When you strike your diamond ring on a sharp edge of rock, a corner of the diamond may fly off. That is because the crys-

Figure 138 . The title of Kneen's article (1928), which emphasises that black diamonds were the most precious gemstones at the time.

In truth, the black diamond was the rarest gem in the world between the XVIII^{e} and XX^{e} centuries: this is not my received idea, but the assertion of Kneen (1928) who already wrote it almost a hundred years ago and which I reproduce here to emphasise a fact that has been deliberately ignored by many so-called "experts" since (Figure 138).

11. The Black Orlov

The case of Black Orlov (Figure 139) is exemplary, as it is the most documented black diamond in ordinary anthologies of this gem. With its brilliant brownish rectangle shape and dark grey colour with bronze highlights, it weighs 67.49 carats (Balfour, 2008). On the subject of its history, this English specialist is quick to express his doubts: "Regrettably most accounts of the early history of this diamond must be treated with the utmost scepticism. According to this author, the diamond was stolen in the 18th century by a Jesuit monk from a statue of the god Brahmā in Pondicherry. Hence its first name: "*Eye of Brahma*", said to weigh 195 carats.

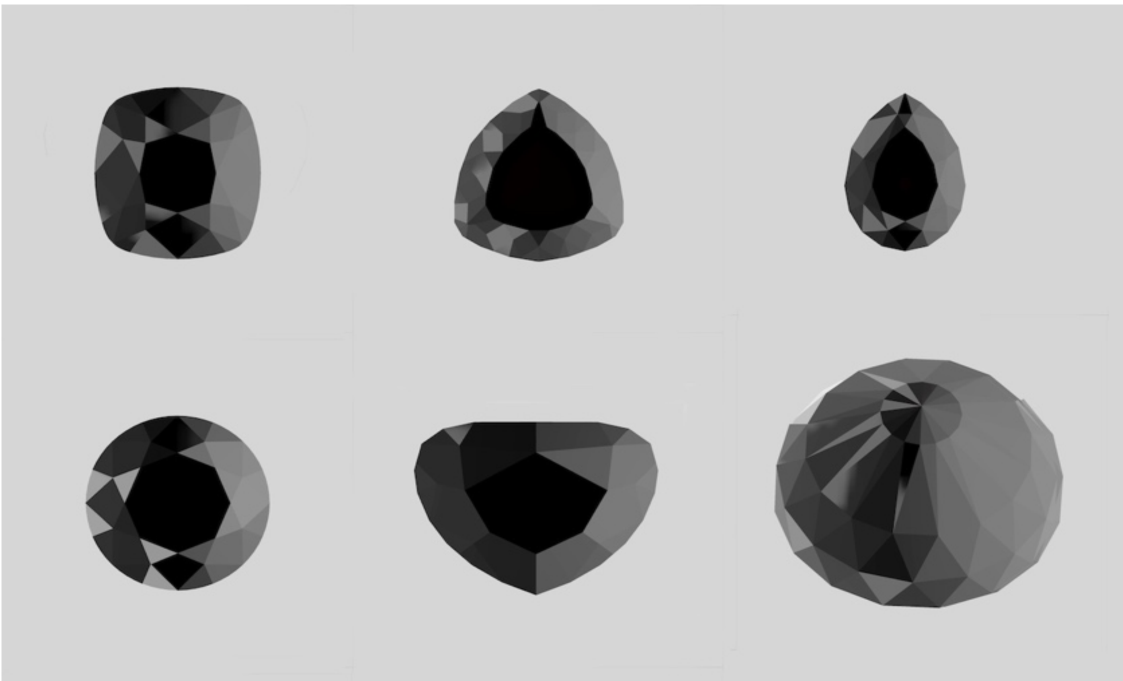


Figure 139 . Simulations (by the author) of six famous large black diamonds, reconstituted to scale: at the top, the "historic" single-crystal diamonds: the Black Orlov (67.49 carats, measuring approximately 25 x 30 mm), the Correya (75.05 carats, 24 x 26 mm) and the Amsterdam (33.74 carats). On the right, the most recent (carbonados): the Korloff Noir (88 carats), the Gruosi (115.34 carats) and the Spirit of De Grisogono (312.24 carats).

This black diamond was found in England in the 19th century, then disappeared before being acquired by a pearl merchant,Jan W. Paris, in 1932. The gem was then owned by Russian aristocrats in exile, Princess Nadezhda

Petrovna (Figure 141), wife of Prince Nikolai Vladimirovich Orlov from the younger branch of Fiodor (Figure 62), hence her name. According to Balfour (2008), the Black Orlov was cut by an Austrian diamond dealer over a period of two years (before 1951) by New York Fifth Avenue dealer Charles F. Winson into three gems – including the current 67.49-carat cushion – "to extinguish its curse". It is not known what happened to the other two gems if this version is true, as Streeter (1879) had put forward a similar hypothesis for the recut Tavernier Large Blue Diamond, but this was not the case (Farges *et al.*, 2008). The dealer J. Dennis Petimezas of Johnstown, Pennsylvania, subsequently exhibited the Black Orlov in London in 2005 before selling it in 2006 (Figure 140).

I have huge Russian princess worries…

Various Russian princesses are said to have owned the Black Orlov, including Princess Léonille de Sayn-Wittgenstein-Sayn (1816-1918). Balfour (2008) also quotes Russian princess Nadia Vyegin-Orlov: "Furthermore, there was never a prince or princess of the aforementioned name because all Princes Orlov descend from the brothers of Catherine the Great's lover, Count Grigor Grigorievich Orlov..."

Not quite right, because in truth, Grigor's youngest brother, Fiodor Orlov (1741-1796), started a second line of Orlov princes, including his great-great-grandson, Nikolai Wladimirovich Orlov (1891-1961), who in 1917 married Princess Nadezhda (or Nadejda, known as Nádia) Petrovna (1898-1988) (Figure 141). This Russian aristocrat, an Orlova by marriage, is reputed to have owned the Black Orlov as early as the 1930s. Nonetheless, some writers thought it necessary to reverse the course of time by claiming that the diamond had been mined in Russia because of its Orlov provenance (even though black diamonds were indeed mined as early as the 1930s at Lebedinoe in the Republic of Sakha or Yakutia). The same princely difficulties are encountered with Korloff Noir: according to the Korloff website, its name is linked to the Russian noble family of Korloff-Sapojnikoff. This name is untraceable: according to Russian media that cite no source, it would be the Карловых-Сапожников (Karlovykh-Sapozhnikov) of St Petersburg. Complicated!

Figure 140 . The Black Orlov diamond, a carbonado set and surrounded by colourless brilliants to form a sound pendant (necklace not shown here). Picture © GIA (with permission).

Figure 141 . Unknown photographers: Prince Nikolai Vladimirovich Orlov (1921) – his wife, Nadezhda Petrovna, Princess of Russia (1917, the year of their wedding). Credits: Agence Meurisse (Gallica, BnF) and Wikimedia Commons (source: www.forum.alexanderpalace.org, public domain).

British gemologist Alan Hart, who presented this diamond in London in 2005, could not be righter when he said: “The intriguing legend of the Black Orlov highlights the powerful way that diamonds have captured human imagination for thousands of years”. Indeed, the ancient story of the Black Orlov seems scarcely distorted from that instrumented for the Bapst Black Diamond, itself derived from the Orlov through Dutens (1777). Could it be that the Eye of Brahmā is, in fact, the Diamant Noir of the Bapsts, later recut as the Black Orlov? Or that it has since been re-cut to, once again, make people believe its provenance on the pretext of extinguishing a supposed curse? (See the proven case of the large 296-carat Devonshire sapphire whose provenance was knowingly made up and falsely Indianised so that it could then be sold back to the Branickis; Farges, 2015). I would never dare cross this line for lack of evidence (even though the number of black diamonds of this size was very limited at the time, the second one did appear when the Maison of Bapst disappeared in 1930, the measured weight of 195 carats is close to my estimate of around 200 carats and their provenances were similarly disguised by Indianisation).

However, photographs of this diamond (such as the Figure 140) seem to show inclusions emblematic of carbonados, which seems incompatible with the stone's Hamilton provenance (18th century). The gem's appearance even corresponds to the discovery of Central African deposits (1930s), even though this type of polycrystalline black diamond was very difficult to facet at the time (some succeeded by using more than ten times the mass of the final gem in diamond powder for polishing). Future research may tell which hypothesis is more likely.

12. The modern black diamonds

As a result, many great black diamonds continue to enrich the history, real or imagined, of this gem that leaves no one indifferent. Black single-crystal diamonds from Asia or Brazil (but also from Africa) have especially attracted a few rare collectors, mostly American, who have always been interested in coloured (or fancy) diamonds. The Hope and Tiffany diamonds (among many others; Figure 127) found their way to North America, as did the Black Orlov.

Two other historically documented black diamonds (Balfour, 2008) are the Correya (found weighing 186 carats, faceted into a triangular cushion of 75.07 carats) supposedly originating in Bahia and then cut in Goa in India (or Lisbon) and the Amsterdam (pear cut, 55.85 cut to 33.74 carats; Figure 139). The Black Star of Africa (202 carats) is a discreet diamond but has also been known since the early 1970s (which argues in favour of a monocrystalline texture). They may also have been faceted from African crystals in South Africa.

Then there are the many large carbonados mined since 1925 in the Central African Republic, almost forgotten after the crash of 1929 as they were replaced by ultra-hard industrially produced materials. In 2007, a Geneva jeweller told me that his father had once arranged to have a large black diamond cut by a diamond dealer in India. After three years of uninterrupted polishing (!), the diamond merchant died suddenly, but only one facet was vaguely polished. A few years later, the jeweller was able to finish the gem using a laser. The gem is currently set on a magnificent bodice front (*stomacher*), triangular in shape and elongated at the bottom, which is intended to cover the upper part of an old-fashioned dress, including a woman's bodice or corset and, in particular, a French-style court dress from the 18th century or a neoclassical dress from the 19th century. But why design such a historically inspired piece of jewellery, rarely used today, with such a contemporary gem? Because this jeweller is a great admirer of 18th century fashion, which inspires his contemporary creations.

Lebanese-Italian jeweller and entrepreneur Fawas Gruosi introduced other faceted black diamonds, including the heart-shaped Gruosi (115.34

carats) faceted from a natural volume weighing 300.12 carats. He also created a unique watch set with black diamonds for watchmaker Chopard (Gruosi, 1999) and more than 3,000 black diamond creations. He fashioned a carbonado from the Central African Republic (587 carats) into what is known as an ancient mogul shape (inspired by the lost Indian diamond known as the "Grand Mogol", which weighs 180 carats and is known from a drawing by Tavernier, 1676): this gem black diamond is rather a contemporary half-pink weighing 312.24 carats, which he named the Spirit of De Grisogono after his former Maison in Geneva (Gruosi, 1999), and which could be similar, in spirit but not in execution, to the Bapst's Black Diamond.

Lyon-based jeweller Daniel Paillasseur founded Maison Korloff in 1978, named after this black diamond according to the company's website, which is currently run by François Arpels, a descendant of the founders of Van Cleef & Arpels. The 200-carat gem (or 421 carats, according to other sources) is said to have originated in Siberia (more precisely in Lebedinoe near Aldan in Yakutia) and is clearly a carbonado. It is said to have been recut in Antwerp over a period of eighteen months in the form of an 88-carat round brilliant, the Korloff Noir (Figure 142). This black diamond is regularly exhibited in the Rue de la Paix and on world tours, including one to China.

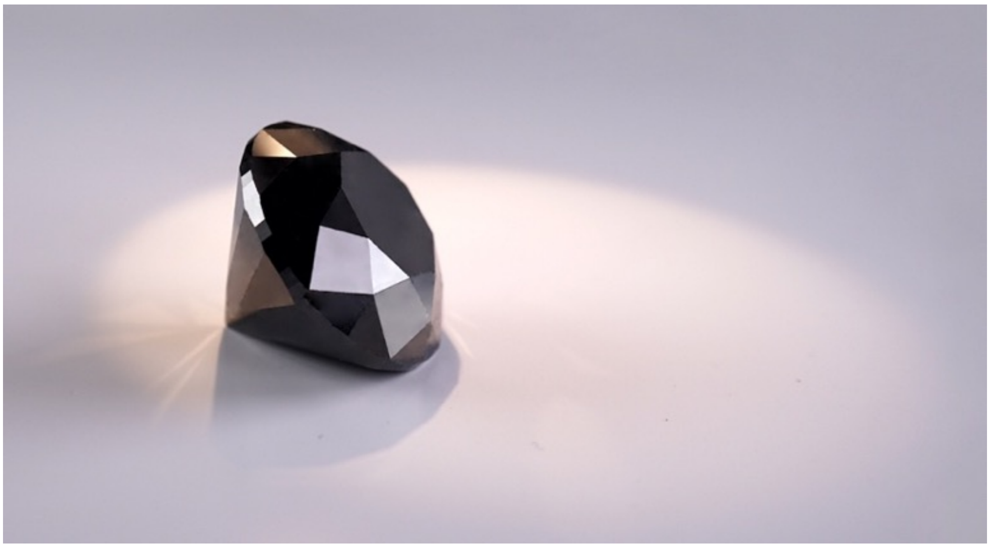


Figure 142 . The Korloff Black diamond. Photo: © QuentinDupont, 2019, Wikimedia Commons (Creative Commons Attribution 4.0 International, slightly cropped).

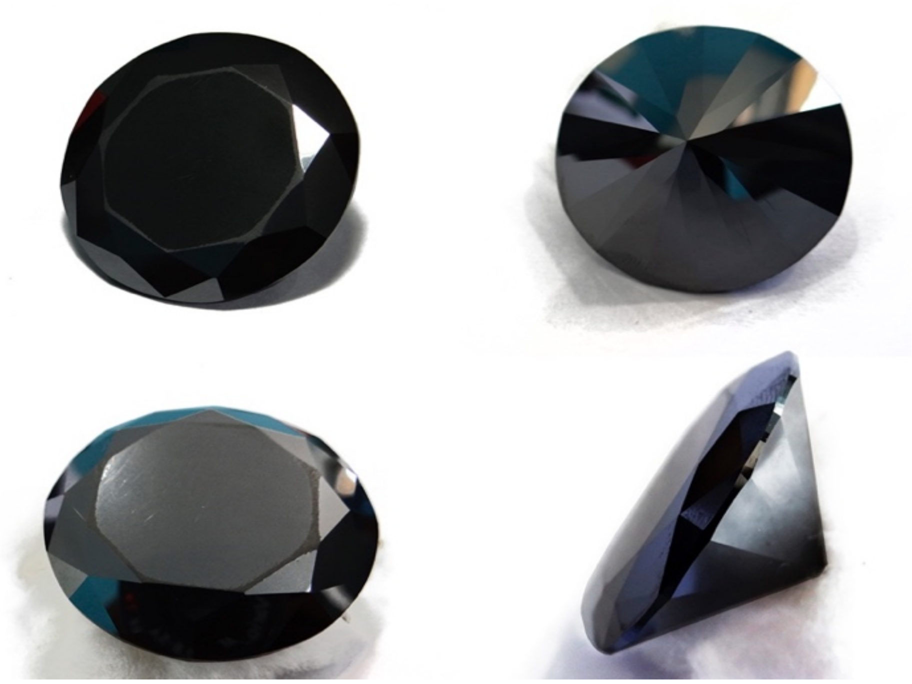


Figure 143 . The 121.32-carat Shaan-e-kolkata: this other little-known gem is claimed to be a faceted black diamond of natural origin (which remains to be verified). Photos: © Thumpy894, Wikimedia Commons licence (Creative Commons Attribution-Share Alike 4.0 International, cropped and assembled by FF).

Not forgetting the Table of Islam (160.18 carats, shaped like a rectangular, stepped table known as an emerald), also of Central African origin and laser-inscribed with "God is great" in Arabic, as well as an unnamed and mysterious "monster" weighing 489.07 carats and rectangular in shape (Balfour, 2008). There are many other diamonds from more obscure sources, such as the Raven, a trillion-shaped black diamond weighing 12.78 carats, the Black Moon weighing 27.77 carats and the Shaan-e-kolkata weighing 121.32 carats (Figure 143). The latter two are round brilliant-cut diamonds, whereas a black diamond does not need to be faceted in this classic shape, which only makes sense for gemstones (a checker facet, for example, would be much more original and magnificent). Kammerling *et al.* (1990) studied an adornment in which six black diamonds are the central gems of each jewels. The set is composed of a pendant with a heart-shaped black diamond measuring approximately 19.20 x 20.70 x 9.60 mm; a ring with a round center stone measuring approximately 16.05-16.20 x 10.02 mm; and a pair of clip-back

drop earrings, each containing two round black diamonds ranging from 11.0-1 1.2 x 7.85 mm to 12.7-12.8 x 9.6 mm. Not forgetting either the Rembrandt diamond, a 42.27-carat, round brilliant-cut black diamond cut from a 125-carat natural stone that took three years to cut and polish. The gem is currently exhibited at the Diamond Museum in Amsterdam.

Figure 144 . Detail of the neo-classical *devant-de-corsage* jewel adorned with a 119.77 carats black diamond (carbonado-type) and colourless diamonds (all cut according to the French 18th century tradition). Source and credit: Horovitz-Totah, SA. Image : © François Farges.

Historic black diamonds are also resurfacing, overshadowing the many small black diamonds of today, almost all of which are treated (like today's onyx or turquoise). In 2007, Herbert Horovitz, a famous Geneva jeweller, told me

that his father had once entrusted a diamantaire in India with the faceting of a large black diamond, a carbonado from the Central African Republic. After three years of uninterrupted polishing (!), the diamond cutter died suddenly, but only one facet was polished. A few years later, the jeweller was able to use laser technology to complete the gem, which has a cushion-shaped oval shape and weighs 119.77 carats (Figure 144). This black diamond, with barely perceptible grey-brown highlights, is currently set on a *stomacher*, a downward-pointing triangular brooch in the style of the early *Belle Époque* (fourth quarter of the 19th century). It was designed to adorn the upper part of a dress and, in particular, to embellish a bodice. The many colourless brilliants and the large black diamond cushion are cut in the old-fashioned way (with a colette on the reverse), a facetting particularly prized by the great jewellers because it is less "cold", more variable and has become more original than today's modern brilliants, which are too standardised. In addition, three dangling briolettes, including a large one, add movement to the jewel.

Another example, in 2021, London's Natural History Museum exhibited the little-known 93-carat Anastacia diamond. It comes from a 300-carat specimen mined in the 19th century, probably in Brazil, and then fashioned in Goa (Hansen and Rennie, 2022). Since then, the Anastacia Diamond has remained in the same family as its current owner. It was set in an Arabian-inspired mount showing a crescent moon and the Big Dipper constellation, outlined by rose-cut yellow diamonds. It was set in white gold, which once again plays on the chromatic contrast of white and black so prevalent in the 19th century. Like the Black Orlov and Geneva black diamonds already mentioned, this gem is adorned with shimmering inclusions.

Hansen and Rennie (2022) even show the extent to which black diamonds are back in fashion, just as they were in the 19th century, but in a completely different way. In the film "Sex and the City 2" directed by Michael Patrick King (2010), Mr Big gives Carrie Bradshaw (played by Chris Noth and Sarah Jessica Parker respectively) an engagement ring set with a 5-carat round brilliant black diamond, designed by Itay Malkin, a jeweller who also specialises in black diamonds. I forget many as the trend is here.

From princes to influencers

While I worked on these black diamond rediscoveries, I seemed to detect a fashion for jewellery that was imposing (up to hundreds of carats) but paradoxically discreet (no iconography seems to have survived) with a hint of the masculism of the time. These jewels were designed for high-ranking, supremacist aristocrats of the 19th century who were keen on military rigour to enhance their reputation for intractability. They are often clad in black and covered with knighthood insignias of various orders, preferably in silver metal enhanced with enamel, unlike their silvery predecessors from the 18th century when the knighthood insignias were, like the portrait boxes of the time, diamondiferous.

Once again, I was wrong. I soon realised that, long before Coco Chanel, these ladies had become infatuated with black diamonds, precisely in order to break out of these immobilist shackles, as a counterpoint to the plenipotentiary jewellery of colourless diamonds that served the image of their proclaimed virile husbands. This fashion is not unlike that of today's rappers who wear branded jewellery, high jewellery for the wealthiest, but “left bank” as we say in Paris (not the right bank of the Seine where most luxury Maisons are housed); all in a deliberately outrageous and ostentatious mess to feed social networks. Beyond this already frazzled fashion, a new generation of these “Men Van Cleef” and consorts are looking for a different kind of elegance, more youthful and metrosexual than testosterone-driven, where the combinations, though more sophisticated, remain imperfect but on the way to success (in my opinion). Here again, rather than an overt, motley assemblage, a more subtle ying-yang, onyx and mother-of-pearl – soon to be black and colourless diamonds – enhanced by a gold setting that's not yet fully coordinated with a world-famous sportswear brand in semi-gloss synthetic and flocked with hideous sponsor logos, but which clearly announces a popularity – and therefore a certain legitimacy – where the mature military-industrial alpha male has been transfigured into a sporty-influential connected kidult.

In 2022, an enormous carbonado cut with 55 facets and weighing 555.55 carats (!) was auctioned at Sotheby's under the name “The Enigma”. Although its iconography is abundant on the web, I was not allowed to use it. Its faceting is called “free-form” and was specifically designed to obtain this series of

numbers, 5, which is highly symbolic in East Asia. More precisely, this shape is called "lasque" and it has been developed in India since at least the 17th century (Tavernier, 1676; Farges et al., 2008). This type of asymmetrical geometry is reminiscent of Tavernier's large blue diamond of around 115 carats: the gem is generally polished as close as possible to the natural specimen in order to maximise volume and reduce losses during polishing (Figure 145).

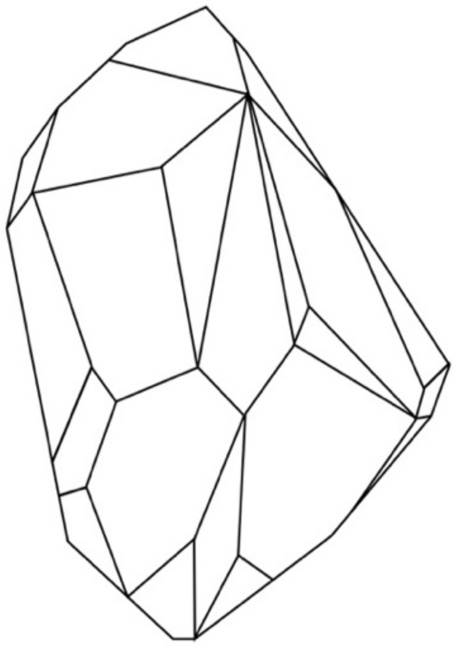


Figure 145 . Approximate diagrams of the 555,55 carats diamond showing a lasque faceting. See also the Tavernier Blue diamond of ca. 115.4 carats (Figure 124).

In retrospect, we can see that the very academic faceting applied to these black diamonds (cushions, brilliants, pears, etc.) did not break away from the standardised faceting developed for gem diamonds, whereas the former, because of their low transparency, did not need to be optically optimised. This novelty confirms the diversity of potential new shapes to be exploited, following the example of jet in the nineteenth century or, more recently, obsidian, black sapphire, coral, haematite, schorl (tourmaline), melanite (garnet), black spinel or jadeitite.

The Enigma, a revealing case of communication

Journalists specialising in science have described The Enigma gemstone as a “diamond’ and above all as “black”, “legendary” and “extraterrestrial”. If we want to be scientifically rigorous, none of these four words is correct, because in reality it is less a black diamond per se than a dark brown carbonado or diamantite, with no myth about its provenance and of unknown origin. Curiously, this scientific terminology is not used by the gemological analysis laboratories (Gübelin, GIA) in their reports (reports 0407010 and 172246401 which can be consulted here: https://bit.ly/3nxymw6). Instead, they refer to a “black diamond” whose colour is even described as “fancy black” on the front page. However, the appendices state that it is more of a dark yellow-brown with orange to red areas. Its origin is kept confidential (so it's not a legend). Finally, its origin is rightly described as controversial. However, only the extraterrestrial hypothesis is mentioned and detailed, because it is spectacular, even though it has been widely questioned for years. This exceptional gem deserves better than the articles that praise it too superficially.

13. Black diamonds in Asia

Many Asian cultures are keen on black diamonds and the symbolism they can represent, as we have seen with the Tablet of Islam, Anastacia and The Enigma black diamonds. What's more, their industrial alter egos, which have enabled the development of rail and sea transport as well as mining and oil extraction, are not regarded in the same boring way as they are now in many parts of Western Europe, where these facts are more often than not absent from articles by jewellery journalists, whether deliberately or not, because they are stigmatised as “not glamorous enough”. This kind of discourse, which promotes a certain form of superficiality, carries with it the seeds of economic decadence (to my opinion), of which European de-industrialisation is the vanguard, to the benefit of a culture overly focused on pure aesthetics. It is reminiscent of the situation in Venice in the 18th century, which, to put it simply, turned away from its founding trade towards a society focused essentially on emotions and instant pleasures. And yet, in the 19th century, did not our forebears talk about the “Industrial Arts” and “œuvres d'art” in French when referring to a metallic bridge, among others during the Universal Exhibitions in Paris in 1855 and 1867? In the same way, in Asia today, information of an industrial nature is seen as further evidence of the exceptional qualities of black diamonds, particularly carbonados, and rightly so.

Even “black jadeite” is currently benefiting from the same favourable conditions in East Asia where “imperial jade” (which includes various types of bright green chromojadeitite rocks, first extensively studied by Alfred Lacroix in 1930, and called 翡翠 in China, *fei cui* to be pronounced “feyTsuey”) has been the most prized variety of precious jadeitite in East Asia since the second half of the 18th century. Instead, “black jadeite” is an ultra dark green ferrojadeitite rock getting fashionable (formerly known as “chloromelanite” in France since 1865, now seen as a type of ferrojadeitite which was widely used as an axe head or even as an ornament in the Western European Neolithic period). Black jadeite is now highly prized in Asia, as are other “colour” varieties such as the lavender and the white/colourless ones (named “icy”).

14. Black legends for black diamonds

Despite the evidence, many jewellers have disparaged black diamonds, and some continue to peddle this misinformation. One might be surprised by such denial on the part of some of today's ‘experts’ on these subjects, who are often self-proclaimed simply because they have been collectors of rare gems, work in a high-end jewellery brand and/or have a degree in gemmology. But this is without taking into account a certain bad faith that still persists today, particularly in the jewellery industry (not just in Paris), which is ironic to say the least. In truth, many jewellers are unable to supply their customers with high-quality black diamonds on a consistent basis, as they are extremely rare. This is in contrast to colourless diamonds, which are sometimes overproduced, even those of the highest quality, which are deliberately kept in short supply (concept of artificial rarity) thanks to an organized scarcity marketing (see Proctor, 2001).

This denial is not recent, as Proctor (2001) also points out: it seems to me to date back at least to the 17th century, with Jahangir in India (1718) and, in the same vein, Tavernier and his contemporaries in Europe. This discourse among gemstone connoisseurs (collectors and dealers) was quickly taken up by certain jewellers, as they could not supply black diamonds with the same consistency as colourless ones, as indirectly reported by Nicolas (1787, p. 204) who states that black diamonds are the rarest, but not the most beautiful (along with blue diamonds!). Antoine Théodore Chevignard de La Pallue (1732-1808) echoes this increasingly ambiguous discourse, which is tinged with scientific truth but already discriminatory from a commercial point of view, as it seeks to influence customer tastes (translated): “As for black diamonds, they are the least esteemed of all diamonds, because this colour gives the stone a darkness that interferes with its play.” (1788, p. 22).

Ignoring the evidence and achievements of their predecessors, a number of dealers gave black diamonds a degraded, if not sinister, reputation as a *black legend*, which was easy for them to maintain, given the European cultural context surrounding the colour black at the time (Proctor, 2001). This persists to this day, as I recently heard from a number of Parisian experts (and friends,

translated): “black diamonds are all treated”. In other words, none of these black diamonds are authentic. Yet these renowned specialists continue to sell the most beautiful (oiled) emeralds in Paris, the most beautiful (dyed) onyx in high jewellery and other turquoises (impregnated with resin) to ultra-VIP clients.

Along with some jewellery brands, journalists from the world of luxury goods and other influencers, hungry for likes, have been the most effective at spreading this kind of fake news. These rumours thrive alongside supposed curses, such as that of the Hope Diamond, forged by Pierre Cartier in 1908. Some American politicians were even convinced that the inauguration of the gem on 10 November 1958 at the Smithsonian Institution (the equivalent of the French *Muséum national d'histoire naturelle*, but in Washington) would mark the beginning of America's economic and political decline. However, we have since seen that this was not really the case. Incidentally, I have held this gem in my hands, mounted and unmounted, for 20 years. I should have died long ago: after falling into a downward spiral of vice, alone and abandoned by everyone, then eaten by dogs that I hope were rabid. I am still waiting for that great fatal outcome to fuel my own dark legend.

More seriously, here is the first of the poisonous legends surrounding black diamonds: “Do black diamonds really exist?" ask jewellers in the world's major capitals, whom I shall not name. Despite these historical chronicles and the work of mineralogists, there was a lively debate, even recently, about the very existence of black diamonds. However ignorant they may seem, some jewellers vehemently assert that they know everything, as Bruton (1978, p. 110-111) summarises: “Prominent diamantaires have long declared that there are no black diamonds and that they exist only in detective stories”.

A second black legend. Those who eventually recognised the existence of black diamonds then moved on to another form of denigration linked to their colour. More generally, some jewellers believed that coloured diamonds, along with all black gemstones, were of inferior quality. Here too, the argument was easy to make, as it was deeply rooted in Western culture, but also, more curiously, when India was ruled by Muslim Mughal. Yet black gems

had been prized since ancient times, with obsidian, then onyx, slate, black marble, etc. (Figure 146). But in the 17th century, the Mughal emperor Jahângîr and the merchant Tavernier agreed: the purest white (i.e. colourless and without impurities) was the most desirable, and anything that deviated from this became suspect. Black was their archetype of indelibility: the Mughal emperors closed Indian mines that produced too many black diamonds (Tavernier, 1676).

Figure 146 . Some of the overall "black" gems (from top to bottom and left to right): serendibite – actinote – haematite – aegyrine – tectite; neptunite – ilmenite – cassiterite – columbite – schorl; shungite – gahnite – melanite – painite – rutile; coral limestone – spinel (ferropicotite) – jet (jayet) – onyx – septaria ; nephrite (Turkish *haldili*, 17th century) – merlinite (gabbro) – obsidian (pharaonic mummy's eye) – jasper/wood fossil – jadeitite (European Neolithic); slate (Chinese inkwell, 16th century) – graphite (Alibert, 19th century) – Grand Antique black marble with micromosaic (France, 19th century). Photos: © François Farges/MNHN.

The use of black gemstones became acceptable in the 18th century, as we have seen with the Begum Dupleix, the Hamiltons and many others. Then they were also set in mourning jewellery in the 19th century (Figure 147). The 19th century also saw the arrival of the first large shipments of black pearls from Polynesia (1845), including the large three-strand necklace privately owned by Empress Eugénie (sold at Christie's in 1872). Later, hematite, spinel and black sapphire were just as ostracised as black diamonds by certain jewellers until recently, whereas collectors of (isolated) gems seek out many different species that are never mounted in jewellery but adorn many collections of isolated gems as works of art (Figure 146).

Figure 147 . Anonymous: Mourning necklace, 1880s. Jet, silver and silk, 31 centimetres long. Stockholm, Hallwyl Museum, inv. HWY XXV:III:E.a.08. Photo and credits: © Hallwyl Museum / Helena Bonnevier (Wikimedia Commons, CC BY-SA, public domain).

The infox machine gets going on

The tremendous industrial boom surrounding black diamonds, and their stratospheric price, meant that jewellers could no longer offer them to their customers. This industrial greed and their unavailability, combined with their black colour, contributed to the denigration of this gem, a prejudice that still persists to some extent today.

For instance, Antwerp merchants Jacobs and Chatrian (1884, p. 419) rejected scientists' discoveries about black diamonds (carbonados, translated): “Whatever some mineralogists may say, carbonado is not crystallised carbon. In none of the many fragments that we have subjected to microscopic analysis have we seen the slightest trace of crystallisation... This mineral sometimes presents scales similar to those of graphite; in reflected light they would be mistaken for small crystals, which is probably what surprised observers who thought they saw crystals and falsely concluded that carbonado is to diamond what sandstone is to quartz”.

These dramatically erroneous writings may seem convincing, thanks to the power of persuasion inherent in the world of trading. Armed with a good dose of bad faith, they try to discredit the scientific discourse that over-constraint their trade. More generally, as soon as traders try to confront science, the result can be as excellent as it is mediocre or even counter-productive, as this writing shows. In his time, Haüy (1817) was the first to impose the constancy of mineralogy in the face of “expert appraisals” that varied from one dealer to another for the same gem. Later, the Gemological Institute of America, GIA, introduced the 4Cs of diamonds (carats, colour, clarity and cut) to guide the buyer in a consistent manner, regardless of the seller. However, some dealers have tried to differentiate themselves from their competitors by introducing pseudo-scientific concepts such as a “5th C” (part of their “5Cs”). The website www.diamondregistry.com website lists various examples of this 5th C that it considers misleading, such as “Cost”, “Character” or “Confidence”, while introducing “Certificate” (even though it is not recognised by the GIA, just like its variant “Certification”). This 5th C, or its variants, is simply some consequence of the first four. It is therefore superfluous, and even counterproductive for the customer, who ends up getting lost in it and losing confidence, or even falling back into a situation that Haüy was already criticising in 1817.

15. Towards widespread denial

After the denial of existence, the question of the origin of black diamonds came as a third sentence. Balfour (2008) believes that India (and Borneo) did not produce black diamonds even in the 19^{th} and 20th centuries, writing: “However, there is no evidence of black diamonds being found in India, let alone one of such size, and it is unlikely that a black diamond would have been retained because by and large black is not considered an auspicious colour among Hindus”. This sentence is unfortunate for several reasons. Firstly, historical chronicles contradict it from the point of view of deposits, as we have seen with Tavernier and Dupleix. Secondly, the lack of evidence concerning the mining provenance of historic Indian diamonds concerns all the “Golcondes”: the Koh-i-Noor, the Sancy, the Florentin, Tavernier's Great Blue Diamond, the Orlov (and so many others) which have no known history other than speculation, except for the case of the Régent which is the least poorly documented (Farges, 2020). Finally, to reduce Hinduism to a generalised rejection of the colour black is to misunderstand this religion, for although black is indeed considered a bad omen by a majority of believers, this does not mean rejection or negation: it is linked to mourning, as in the West, and more generally to a lack of happiness, which has as much reason to exist as its opposite. Black is even the colour of the god Shani, linked to the planet Saturn, who rewards or punishes everyone after their earthly life. Legrand (1980, p. 15) asserts that (translated) “We know that the white octahedron was consecrated to the god Indra, the incarnation of storms, thunder, and lightning. Black diamonds, especially those in the form of twin crystals that suggested the head of a serpent [i.e., with a triangular shape], were dedicated to Yama, the god of death”. There are even Hinduists who wear black clothes during their worship, notably at the Sabarimala temple (in Kerala), where black *mundus* (lower garments known as *dhotis* in the north) are worn during ceremonies. Fourthly, if one ignores Tavernier, and if India has produced so many large diamonds of different hues, why would not it have never produced even a black diamond? For example, the 67.5-carat Black Orlov and the 115.34-carat Gruosi heart-shaped black diamond (more on this later) is claimed to be Indian

by the same Balfour (2008). A 25-carat black diamond from Kalimantan (or Borneo in Indonesia) was examined by Tay Thai Sun, director of the Far West Gemmological Laboratory in Singapore (Sun *et al.*, 2005). In the 19th century, Babinet (1855) experimented with faceting a black diamond from Borneo, which led to a lapidary disaster (as we saw in the first chapter). Streeter (1879), meanwhile, claims that it was possible to facet a Borneo black diamond with his own powder (confirming Babinet). He even adds that they are magnificent diamonds despite so rare. In the end, the truth about black diamonds is quite the opposite: the prestigious Indian origin known as "Golconde" was even used to embellish the provenance of a fabulous black diamond that was forgotten by specialists, as we shall later see.

A fourth black legend. Black diamonds, whatever their actual mineralogical nature, vary in transparency from totally opaque to translucent. These "defects" are due to the presence of graphite, in inclusions or needles, but also metallic elements (iron, chromium, tin, titanium, etc.) or even minerals (phosphates such as florentine or goyazite). Proeminent scientists like, among many others, Emmnauel Fristch, a gemmologist at Université of Nantes, or Hélène Bureau, a geochemist at the French *Institut de Physique du Globe* in Paris and world-renowned for her research into the genesis of diamonds, have demonstrated after years of research that these impurities are in fact scientific riches. Like almost all scientists, they argue that these impurities make up the uniqueness of each specimen and say much more than clear, mute crystals like most faceted diamonds (in short, "be beautiful and keep quiet"; Bureau, 2020).

Indeed, many jewellers make inclusions an essential part of their inspiration: the "gardens" of emerald, the fossils of amber or jet, the inclusions of jasper, the shimmering of aventurine and other veined marbles, which are the very source of their stunning geodiversity, are all inclusions that make these geomaterials so special. From an aesthetic point of view, the shimmering effects of many gems, such as asterisms, labradorescences and other iridescences, are also due to the presence of mineral inclusions, which make up the coveted chromatic richness of certain rubies, sapphires, labradorite and other moonstones, among many others. From a scientific point of view, a gem's

inclusions can even be used to trace its original deposit, which is often forgotten by dealers, or to identify discreet chemical-physical treatments that a gem may have undergone to artificially increase its value without declaring this to potential customers.

Without its inclusions of black magnetite, obsidian would not be as black, which is why Pliny the Elder so poetically described this gem in his *Historia naturalis* as "the mirror of the soul" (Figure 148). This is a far cry from the terms "rough" and "impurities", which are so negatively connoted in everyday life that a number of gemmologists no longer realise it. So, if we accept, for example, obsidian as a magnificent gem that has been appreciated since antiquity, whether around the Mediterranean or in the Americas (I am thinking of Inca pectorals, for example, or iridescent obsidian from Mexico), there is no objective reason to ostracise black diamonds.

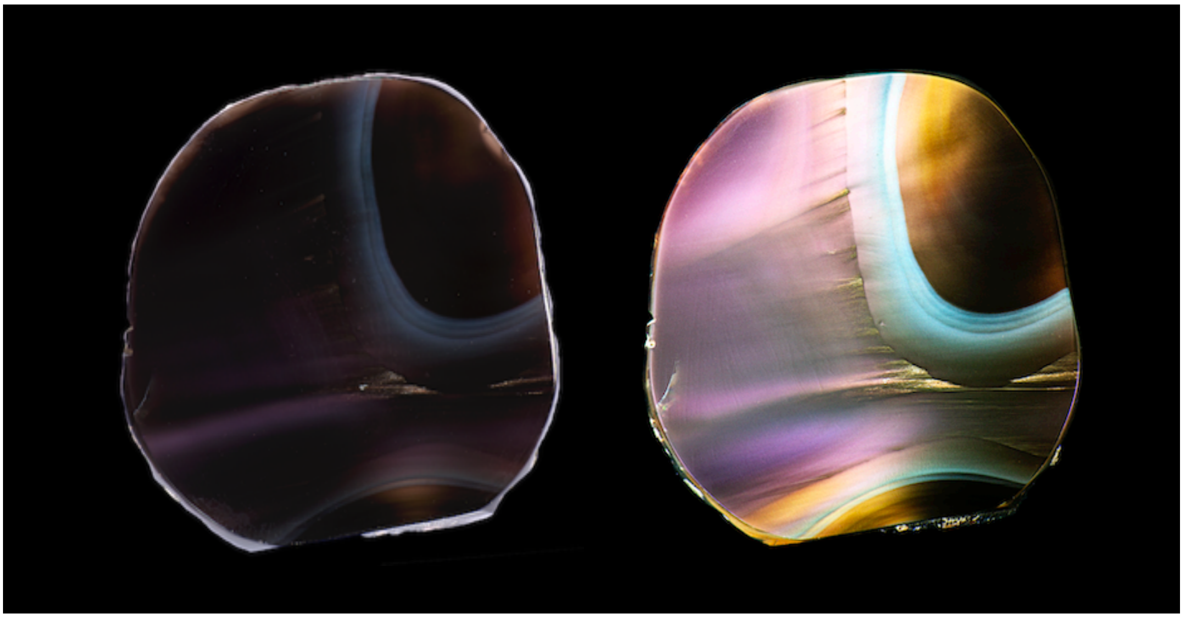


Figure 148 . Rainbow" obsidian (probably from La Revoltosa, Jalisco, Mexico) showing variable iridescence following two different incidences of light. This effect is caused by nanoinclusions of magnetite crystals. Hence, demonstrating the interest of inclusions. Polished plate, 25 x 22 cm, former collection of Roger Caillois, Paris, MNHN, mineralogy, INV. 188.125. Photos: © François Farges/MNHN.

I will pass over two other black legends: "they are all treated" and "they are cursed". The first is so weak that it does not stand up to historical truth. I'll come back to the second, as it can help to detect skulduggery on the part of

certain traders. Because the real curse of black diamonds has nothing to do with the fake news propagated by these so-called "experts", but with the proof of their ignorance on the subject.

AN AWAKENING DREAM

1. London calling

Almost fifteen years after my identification of the most sought-after specimen of Louis XIV's French Blue Diamond at the Muséum national d'histoire naturelle in Paris (Farges *et al.*, 2008), fate has struck again, albeit in a different way. On the 6th of June 2023, I was contacted by an Australian colleague from the *Natural History Museum* in London (NHM), Robin Hansen, regarding the cast of this carbonado, who asked me a question along the lines of: "*Do you know where it is*? *Because Moissan worked with the Museum*! I have already reviewed our carbonados many times, as have colleagues before me. But there don't seem to be any known pieces of this type, as my colleagues tell me. I recompile the list of carbonados and diamonds once again, and nothing appears with the dimensions, or the qualifications of "cast", "Moissan" or "Sergio". The files for each specimen, arranged alphabetically and labelled D for "diamant" and C for "carbonado", provide no evidence of this problem. But what happened to the Parisian cast mentioned by Serre (1913), which Babinski (1897) mentions as having been deposited at the MNHN?

So I replied to Robin: "Sorry, we don't have it". She was sorry too, because I did not dare admit to Robin that it had been lost on the basis of Babinski's writings (1897). Very upset by what seems like a loss, I continue to read the history of this carbonado, including Dufrénoy, Des Cloizeaux and Moissan, whose descriptions of it at the time, its ancient names, its deposits and its current science make it, for me, the greatest unsolved enigma of mineralogy (as explained in the next chapter). More generally, I'm compiling a bibliography on Brazilian carbonados and their incredible industrial use: but what would we do without oil if we hadn't had carbonados!

The next morning, at around 5 a.m. – because annoyance was plaguing my mind after a night shaken by shame – I had a kind of epiphany: I dreamt of the word "carbon" – this strange term used by Moissan and the industrialists – which I found so ill-chosen from our current geological perspective. This immediately woke me up, as I sensed an unexplored lead. The computer

started up, and off I went! Instead of looking for the D's in diamond and the C's in carbonado, I look for the C's in carbon. And the computer confirms my human hunch: there is a “carbon” record that corresponds to a cast given by “Mr Moissan” of a Brazilian specimen inventoried inv. 96.135 (135th specimen from 1896; Figure 149).

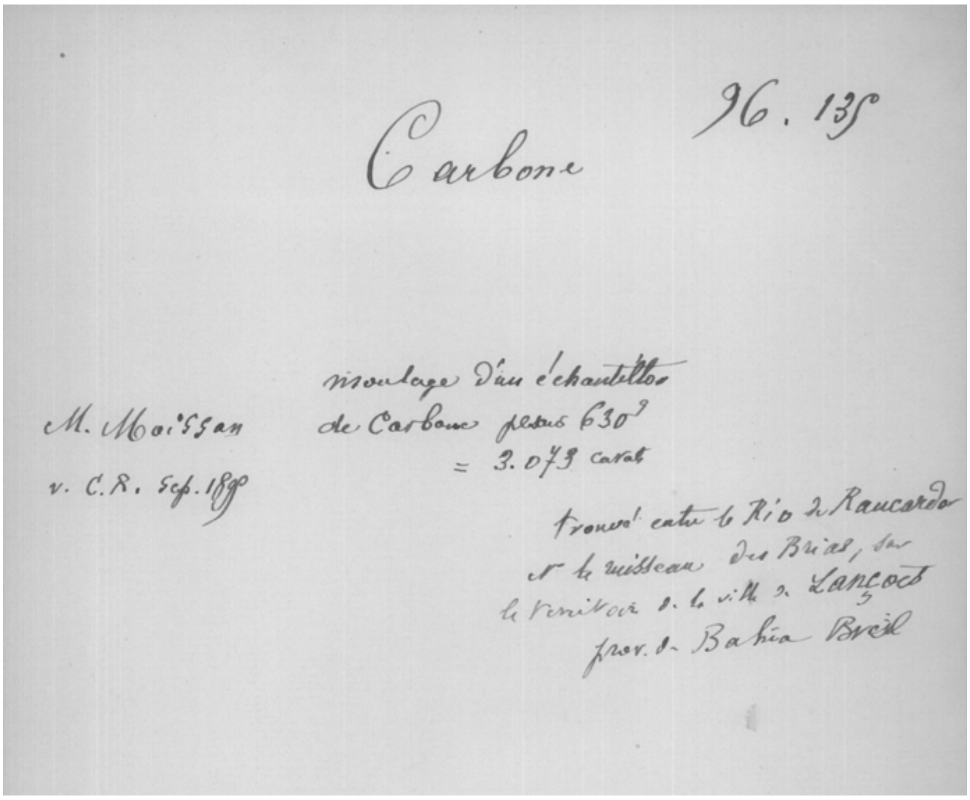


Figure 149 . The carbonado Sergio record was inventoried in 1896 as “Carbon” and then with an “e” (“Carbone”), not as “diamant” or “carbonado” (and not updated to as “Sergio”). Note also the transcription errors for Brazilian localities: “rio Roncador” became “Rio de Raucardor” (same error as Moissan, 1895a,b), and the stream “das Bicas” became “des Brias” (another error by Lacroix). Source: Direction des collections, MNHN.

I'll pass over the other errors Lacroix made in copying Brazilian localities and his horrendous writing, with no consideration for his successors, as we can see. But I recognised familiar names, albeit distorted by Lacroix: “Roncador” had become “Raucardor”, “Bicas” transmuted into “Brias”, and so on. After this alphabetical card, I consulted the general inventory where the specimens are listed by year of acquisition, this time because I finally have its inventory number. The second piece of good news is that it is stamped with a cross (Figure

150), which means that the corresponding sample was present at the time of the 1937 check of the entire collection. A technical photograph taken during the last inspection in 2008 confirms the close resemblance with the 1895 engraving and its historical photographs (1904 and 1906).

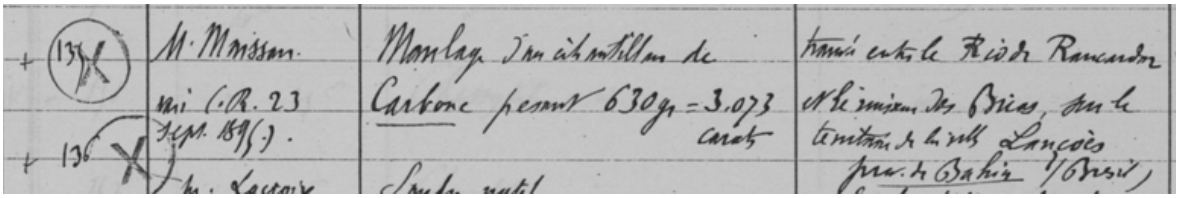


Figure 150 . Extract from the general inventory of the MNHN's heritage mineralogy collection, in the horrible handwriting of Alfred Lacroix. The cross stamp confirms the specimen's presence in the collection. The “3,073 carats” are in old Paris carats (karats), which make 3,150 current carats (630 g). In reality, the specimen weighs 633.6 g, or 3,168 carats, and not 3,150 as indicated, to the nearest 1 karat when it was discovered. Source: Collections Department, MNHN.

I am overcome by a dizzying feeling of great solitude: I knew this specimen of carbon donated by Moissan. How many times had I seen it, how many times had I mistaken it for a fragment of carbon that I had considered to be one of the chemist's industrial syntheses? I am sad that I missed Sergio because I only looked in the Carbonado files, not knowing before 2023 that “carbon” was a synonym for the 19th century. In short, all we had to do was pray to the gods of chance to find Sergio via his “Carbon(e)” file, almost the “carbon” I had been dreaming of. Despite these setbacks, I am further convinced that we have Sergio's casting when I compare it with the available historical iconography. I immediately inform Robin of the good news. Her response was: “What a pleasure to start the day with such a message! As for me, it is above all a new-found honour, an honour for the Museum tinged with dismay at having disregarded it so long.

When it arrived at the Jardin des plantes at the crack of dawn, the open drawer effectively revealed the specimen illustrated between 1895 and 1902 from two different sides (“obverse” and “reverse”; Figure 151). I remain silent, almost reverent, in front of the object, for I had scorned it because of its ugly appearance but also because of a botched inventory in 1896, the consequences of which I had failed to foresee. This cast is so much richer that it deserved better. What was Lacroix's logic that led us to this situation? Why did this

professor opt for the industrial name – which has since become obsolete because it is a misleading homonym for the chemical element carbon – rather than a mineralogical name for a collection of minerals? But what inconsistency prompted Lacroix, in exactly the same year, to mention the carbonados in the MNHN collection in his *Guide du visiteur de la Galerie de minéralogie* (Lacroix, 1896), in which "carbone" is given only as a secondary synonym for the first, carbonado? What similarity of inconsistencies prompted him in 1907 to name more correctly the carbonado specimens in the collection of the late Alfred Des Cloizeaux (Figure 84) that Lacroix had just patrimonialized?

Figure 151 . Two views of the historical cast of Sergio by Henri Moissan, identified in 2023 and photographed as in 1895 (a) and 1902 (b). Gift by Henri Moissan, 1895. Paris, MNHN, mineralogy, inv. 96.135. Photographs: © François Farges/MNHN.

The original label on the Sergio replica accompanying his cast indicates that it was exhibited in the Galerie de Minéralogie (Figure 152). Its reverse side, invisible to visitors, confirms that this object was considered an artificial product ("P.A.") in the same way as, for example, an industrial material, synthetic or artificial exactly like Moissan's trials on diamond synthesis. Moreover, Lacroix's vision, focused solely on the chemical composition, shows that it was the chemistry of the object that took precedence, whatever the

subject represented. With this “first degree” logic, Leonardo da Vinci's Mona Lisa would be classified in the “paint pigments” section rather than in the section dedicated to the Italian Renaissance.

When we consult Lacroix's mineralogical works, we also understand that diamonds were not his major interest, and even less so carbonados, which he discusses very evasively, unlike many other species. It is also clear that he was more interested in deposits on islands (Madagascar, Guinea, New Caledonia, Martinique) than in those in intra-continental cratons such as Brazil and Central Africa, so emblematic of black diamonds. Last but not least, their geological context, sedimentary, did not appeal to this magmatologist.

Figure 152 . Exhibition label (front and back) in the Galerie de Minéralogie. Photographs: © François Farges/MNHN.

2. Other unexpected discoveries

In the meantime, my little bubbling brain machine is back in action. The researcher has found a new muse: unknown, forgotten, dark, misshapen, ugly. I love these unfortunates, they're my favourites because they usually promise innovative research off the beaten track of the so known, so easy to write about, so déjà-vu and so superstar gems like the Cullinans, the Taylor-Burton or the Hope (note: all named after some British celebrities). In contrast, the unfortunates are not conducive to easy subjects, brilliant clichés or grandiose anecdotes that have been trotted out many times before, like the stories of monarchs' diamonds that I am so often asked about. So much the worse if mediators and other communicators, even science journalists, weren't interested, because the subject would be sorely lacking in celebrities with matrimonial scandals. On the other hand, Sergio demands difficult and innovative research. But tells me of billions of years, of poor garimpeiros or *faiscadores* with fertile imaginations, of slaves seeking their freedom, of a fallen emperor, of the superb Portuguese language accented with Brazilian, of a mineral injustice, of a forgotten collector's treasure, of a diamond truly cursed without the recourse of a journalist lacking inspiration or a trader in search of a waky client... In the space of a few seconds, I quickly saw these images blended into a composition that was both brutal and marvellous. And so began a search strategy to understand this specimen.

Its verifiable weight has been underestimated. The cast weighs 633.6 grams, or 3168 carats (metric), the weight announced at the time of its discovery to the nearest 1 carat and which has now become its official weight. That's a difference of 0.2 grams or 0.03%... With this weight, I confess that I dared to fantasise that the original was deposited at the MNHN, that it is standing in front of me, swapped with its model in the manner of a Hollywood thriller and that the London jeweller was fooled by those cursed froggies... In truth, it is a false coincidence – but a fabulous one – as I now explain.

It is therefore now clear that Moissan sought to obtain as perfect a replica as possible in terms of volume and weight, which is remarkable and unique to

my knowledge, especially at that time. Shortly before the publication of this book, I went back through various archives - including Brazilian ones - to double check information that many gemmologists-copists do not take the time to verify. Then, I realised that I had overlooked a major detail: the 1895 weight was rounded up to 3,167 ½ quilates (carats, Pereira, 1895). Indeed, it does not correspond to 181 *oitavas* as advertised, but only to 176.66 of this ancient Brazilian unit of weight (1 *oitava* = 3.586 g = 17.93 carats; Carrara, 2005). In reality, the weight of "3,167 ½ carats" was given in non-metric Brazilian *karat* in the 19th century. It is equivalent to 1.0245 carats today. In this context, 181 *oitavas* are indeed 3,167.72 Brazilian *karats*, almost as announced in 1895 (3,167 ½). However, in today's units, Sergio actually weighted 3,245 carats. This is confirmed, indirectly, by Moissan (1895,a,b) who notes that this specimen "now weighs only 630 g in Paris" because "in the last two months, it has lost about 19 g in weight". These two weights are equivalent, respectively, to 3150 and 95 carats today, or 3245 carats. This second calculation confirms the first for a real original weight of 3245 carats. Similarly, the Cullinan diamond was announced at its discovery in 1905 to weigh 3025 ¾ carats (ancient); a value that was corrected shortly thereafter to 3106 carats (modern), unlike the Sergio whose weight was never corrected until the present book. Wikipedia will have to be updated, although I fear that other proofreaders will correct back to the previous weight, which has been so commonly published, even recently.

Density. Carbonados have densities comprised between 2.80 and 3.48 (Rivot, 1849; Haggerty, 2017; Ferreira, 2020), i.e. an average of 3.20 for those from Bahia compared with those from Minas Gerais, Venezuela, the Central African Republic (around 3.4) or Mato Grosso (around 3.48) and single-crystal diamonds (around 3.52; Meira de Andrade, 1999; Svisero *et al.*, 2017; Ferreira, 2020). In contrast, Haggerty (2014) reports a much lower average density (3.05) on a large number of carbonados from Brazil and the Central African Republic, unfortunately without giving a breakdown of his data by continent. It is also a pity that Moissan did not publish more on this carbonado in 1895, including an estimate of its density: we therefore have to estimate it a posteriori.

Delphine Bradant then scanned Sergio's cast on the MNHN's

SURFACUS platform to obtain a 3D surface model that gives all his dimensions and allows us to deduce his volume. The Meshmixer software gives its dimensions as 9.42 x 8.92 x 6.62 cm, equivalent to a volume of 227 cm^3. This gives a "raw" density of 2.86, but does not take into account the porosity of carbonados, which leads to weight loss through dehydration. A weight loss of 35 carats, which was observed in Brazil just after the carbonado was extracted (Pereira, 1895), increases to around 95 carats (19 g) when the specimen is in Paris, then in London. This loss is due to the replacement of the water contained in the porosity of the original by air, a reduction of around 19 cm^3. This gives a dehydration-corrected density of 3.02, which is almost the average value for carbonados according to Haggerty (2014). This author even points out that this value corresponds to the most sought-after density for carbonado, which garimpeiros measure with a Nicholson hydrometer to define their quality and therefore their price (Haggerty, 2014). There is therefore excellent agreement between our estimate of Sergio's density and its high price recorded in 1895.

Figure 153 . The historical casts of the Sergio (649 g) and the Cullinan (621 g). The clear difference in volume is linked to their disparities in density and porosity. Gifts from Henri Moissan, 1895 and the Premier Transvaal Diamond Mining Company, after 1905. Paris, MNHN, mineralogy, inv. 96.135 and MIN000-2731. Photo: © François Farges/MNHN.

Porosity. This loss of weight corresponds to dehydration of the specimen after it has been extracted from its environment, as carbonados are porous, between 5 and 15% by volume (Haggerty, 2014; Ferreira, 2020). On the basis of these studies, we can then estimate its porosity (wet) at 3% to which we need to add 2% porosity (dry, gas-related) to arrive at the observed value of 5%. This value is a minimum, as there is also the intrinsic porosity of carbonado, which has little influence on its weight. To take this into account, the density must be taken into account. According to Meira de Andrade (1999), a carbonado density of 3.20 corresponds to a porosity of 10%, while a density of 3.05 corresponds to a porosity of 13% (Haggerty, 2014). So, Sergio, with an estimated density of 3.02, had a total porosity of around 13.6%. This significant porosity helps to explain why the Sergio replica appears bulkier (by around 5% in dimensions, or ~ 25% in volume) than the 3,106-carat Cullinan, where porosity is zero (Figure 153).

Casting. The MNHN inv. 96.135 object was cast using the lost wax technique, as can be seen from its many nooks and crannies, which give the cast a curious "broken mouth" expression that cannot be seen in the 1895 engraving (Figure 111). When a cast is made, a fluid material suitable for moulding is used, formerly molten lead (until around 1820) and, since the second half of the 19th century, plaster (Figure 86 and Figure 87) and more rarely glass (Figure 37) and, more recently, resins. In the vast majority of cases, the weight of the replica differs greatly from that of the original due to the great differences in density between the original and its moulding material (glass, plaster, alloy etc.). Here, the person who cast the Sergio not only used a protocol that produced an object with a density close to that of the carbonado in its state in September 1895 (partially dehydrated), but also adjusted its weight as closely as possible to the original, to within 1 carat, or 0.2 grams! To my knowledge, this attention to detail is remarkable in the world of replica minerals (or gems) from this period. Let's now look at its composition to understand its logic.

Composition. At this stage, it is forbidden to carry out in-depth sampling on such a heritage object, which would enable us to understand its precise composition. Indirect, non-destructive methods must be used. For example, when gently struck against a glass surface, this moulding emits a metallic sound reminiscent of a bell, most often made of bronze (a copper-tin alloy of the potin type). Its surface is brownish grey in colour due to a powdery, black and dull layer of graphite that stains the gloves, but which seems to whiten locally on contact with humidity. This blackness is pierced locally by a bright metallic sheen, silver to light bronze, suggesting the probable presence of silver and copper, respectively. When viewed through a binocular lens, a few translucent micron globules and encrustations of a beautiful azure blue, emblematic of cupric glass-ceramics, can be seen underneath. This probably indicates that some kind of refractory siliceous material (clay? sand?) was used as a mould into which a molten copper-rich alloy was cast. Locally, small reactions between the contents and the container clearly formed these microscopic blue globules.

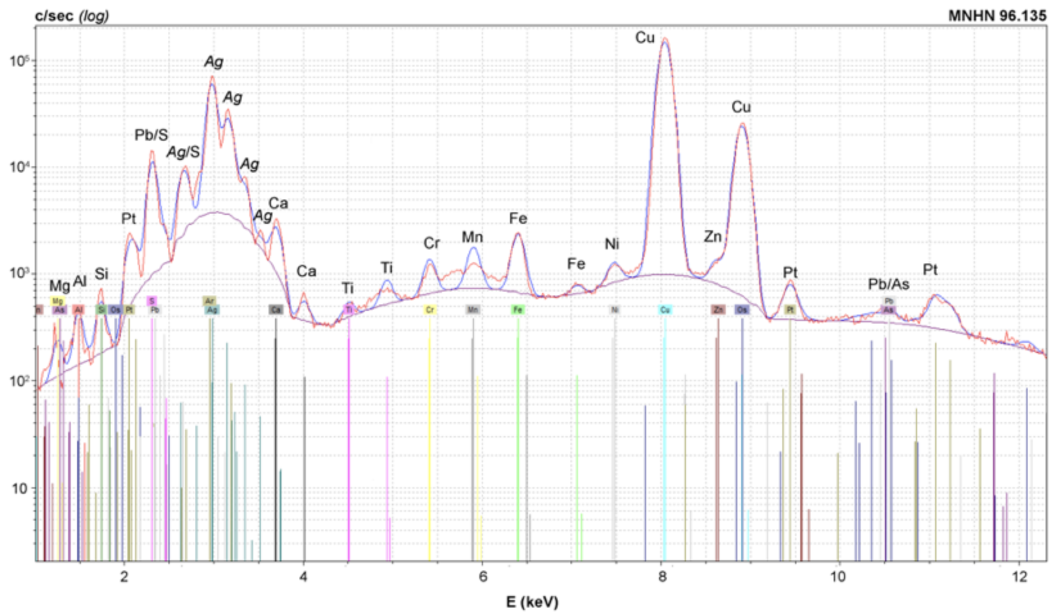


Figure 154 . X-ray fluorescence spectrum (Bruker Tracer 5i) analysed (ARTAX software) highlighting the different chemical elements detected on the surface of the Sergio cast, MNHN INV 96.135. The graph shows the calculated baseline (black), the characteristic X-ray emission peaks of each element detected and their sum (blue), refined to the experimental spectrum (red). Each peak is captioned according to its suspected matrix: elements of the surface silver lacquer (in italics) and those of the copper-magnesium alloy (in bold) from which the other peaks of metallic-type elements (Ti, Cr, Mn, Fe, Ni, etc.) must also have originated. ARTAX graph modified by the author.

Chemical analysis by X-ray fluorescence (XRF portable Bruker Tracer 5) detects a mixture on the surface (Figure 154) of copper (average: 37.3 wt%, hereafter p.%), silver (14.7 p.%; including the metallic underlayer) and magnesium (11.2 wt%) as well as a host of minor elements (Al, S, Ca) and trace "metallic" heavy elements (including Cr, Mn, Fe, Ni, Pb, etc.). Tin is virtually absent, so this is not a bronze- or potin-type alloy used by sculptors, art founders or bell makers. The presence of magnesium is unexpected, but patents for copper-magnesium alloys were filed as early as 1888, such as the one covered by patent no. 178949 filed by the Société industrielle et commerciale des métaux (anonyme, 1889). Its main use is the reproduction of spare parts by moulding. Its presence reduces the density of the alloy compared with copper alone.

Figure 155 . The modern rediscoverers of Sergio: Robin Hansen (Natural History Museum, London), Léonie Rennie (Curtin University, Bentley, Perth, Australia) and the author of this book, together around the historic Kahn-Moissan cast presented as part of the "Treasures of the Earth" exhibition at the Muséum national d'histoire naturelle (Jardin des plantes, Paris) in August 2024.

During an observation session of this casting in Paris in August 2024 with Léonie Rennie (Figure 155), Robin Hansen wisely noticed that the casting must be hollow because of a subtle metallic noise that is produced when it is turned

over carefully: a tiny metallic fragment is undoubtedly trapped in the hollow internal volume of the casting and acts like a tiny bell-ringer that is barely audible. Thanks to its volume model obtained by scanner, we can calculate the "raw" density (uncorrected for porosity) of the replica (2.86), which is much lower than that estimated for the original (3.02), even though their weights are identical to within 0.2 grams. This confirms that the casting is hollow.

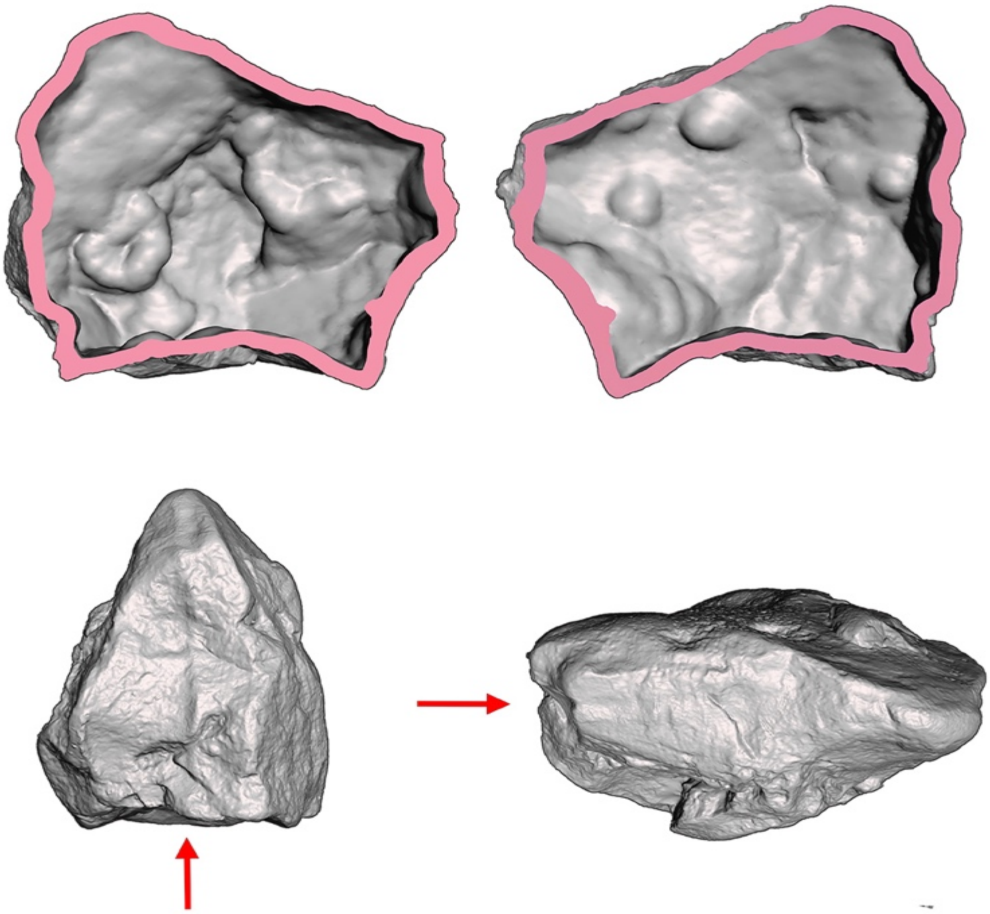


Figure 156 . The scan of MNHN cast 96.135 was digitally hollowed out and then cut in two (Meshmixer). Top: simulation of the internal distribution of the metal, which forms an average thickness of around 3.3 millimetres, corresponding to the object's weight of 633 grams. Bottom: a possible suture line between two parts of the mould (red arrows) that is virtually invisible on the object.

However, its metallic composition makes it highly absorbent to a large number of current volumic scanning techniques, including synchrotron accelerator, which could help us to verify its internal structure. Alternatively, a computer simulation (Meshmixer) can be used to estimate the size of the internal volume (Figure 156): the 633 grams of metal should be distributed all around the

surface over an average thickness of around 3.3 millimetres, forming a solid volume of 72 cm^3 with a considerable void of around 155 cm^3 (for a total volume of 227 cm^3). In addition, the scan reveals a possible suture line in the refractory silicate mould that enclosed the mould during the pouring of the molten metal (Figure 156).

3. An enigmatic savoir-faire

Manufacture. I suggest that a professional caster was commissioned to make this casting. However, rather than bronze, a copper-magnesium alloy was used, containing numerous metallic elements (Ti, Cr, Mn, Fe, Ni, Pb, etc.) that were visibly impure, making it look like industrial foundry waste. The alloy weighed 630 grams and was melted before being poured into a hollow mould, probably in two parts, obverse and reverse respectively, because of the shape of the object. This technique was then commonly used and made using sand (for the mould) and gelatine, or even lost wax (for the object), as explained on the website of the Parisian *Musée Rodin* (www.musee-rodin.fr/en/resources/techniques). After cooling and demoulding, the two parts (front and back; Figure 156) was probably concealed by smoothing with a blowtorch and applying a silver patina that masks the orange colour of the coppery alloy. A final powdery black layer, possibly consisting of graphite, was applied irregularly to obtain a black colour (but obviously too dull for the photographs) that reveals here and there the underlying silver patina that simulates the adamantine lustre of the carbonados. Lastly, I imagine that a final casting vent was left open to insert a metal piece of the required weight so as to adjust the final weight of the object to the nearest carat, i.e., 0.03% (!). Once this imprisonment had been validated, the vent was closed by torch welding. Whatever technique was actually used, this casting is an incredible masterpiece because, in addition to the unexpected accuracy of its weight, its details are also remarkably well preserved (unlike the London castings, which, according to Hansen and Rennie, are less detailed). Here we may feel the influence of the scientist Moissan, who wanted an object that was precise in terms of mass and volume, an accuracy untypical of diamond dealers.

Provenance. Since the Renaissance, dealers in precious stones have commissioned friends and family to make casts (in lead, and then in plaster from the 1850s) of their most important pieces and send them to potential but distant customers to persuade them to buy. The cast was "entrusted" (loaned in confidence, without a lengthy legal loan agreement), meaning that it could

be returned to the seller if the deal did not go through or if the buyer did not want to pay the casting costs. Casts were also made prior to recutting in order to keep a record of their work after the new gem had been returned to its owner (this must have been the case with the Great Blue Diamond of Louis XIV, after it was looted in Paris in 1792 and before it was re-cut into the Hope ; according to the MNHN's 1850 archives, the latter was acquired (illegally) by Henry Philip Hope, then cut into an oval brilliant to conceal the fact that it had been stolen; Farges *et al.,* 2008). Others casts are made for teaching purposes (for future apprentices or for heritage collections such as the Étoile du Sud) or for advertising purposes (for customers or competitors).

As the casting is recorded in the Museum as donated from Moissan, we would be inclined to attribute to him the supervision of its manufacture by a Parisian art foundry as Pereira (1901) mentioned without giving a name. More often, however, gem dealers order the casting of the gems in their possession, as we saw with the two casts of the Étoile du Sud donated to the MNHN by diamond dealer Joseph Halphen. This choice was made for obvious reasons of responsibility: only the owner can afford to undertake a casting operation, which, although not very risky, nevertheless involves the (heavy) (financial) responsibility of the manufacturer, who is often a trusted subcontractor experienced in this type of production. The subcontractor may be the Rudier workshop (Alexis and his son Eugène) who worked, among others, for the sculptor Auguste Rodin using the techniques of the time. Unfortunately, we cannot research in this direction as their archives and their moulds were destroyed in 1952 under Eugène Rudier's will.

If the Institut Geographico e Historico da Bahia finally does us the grace of answering us one day about their casting, it would confirm (or not) that the replica preserved at the IGHB in Salvador was donated by a named Parisian workshop rather than by Moissan, whose connection with Bahia is hard to discern. The rediscovery and study of the Bahian cast would have made it possible to verify whether the two casts were made identically. Pereira (1901) mentions this donation to the IGHB, but points out that the metal used is solid silver, which does not seem logical for reproducing a shiny black carbonado. It is therefore likely that it was the Parisian workshop who had these two casts (or

perhaps more) made under Moissan's supervision and with a view to their subsequent donations to the relevant museums in Paris (1896) and Salvador de Bahia (before 1901).

Donation. The fact that this cast is listed as number 135 in the MNHN inventory for 1896 suggests that it was received at the beginning of the year (around February?), as the general inventory lists 1,532 numbers for that year. Unfortunately, the archives held at the MNHN or the Institut de France (Archives de l'Académie des sciences, fonds 62J and 75J concerning the respective correspondence between Moissan and Lacroix between 1895 and 1896) do not provide any information on this casting, apart from a brief exchange of two letters between March 5th and 8th 1896 concerning kilograms (!) of "sands" (sorted *esmeril-type cascalho*) from Minas Gerais sent by Lacroix to Moissan for dissolution with a view to isolating their diamondiferous microscopic fractions so as to understand their genesis and thus hope to obtain clues enabling them to be synthesised industrially. Inspection of the minutes of the Assembly of the Muséum Professors for the years 1895-1896 (Paris, MNHN, Bibliothèque Centrale, inv. AM 47) makes no mention of this donation. From January to mid-February 1896, Lacroix announced the arrival of minor collections (Blanc, Baron Müller) which were inventoried slightly before the cast (inv. 96.1 to 96.94). After mid-February 1896, he did not announce any further donations, including other collections that were inventoried, such as the Igeström donation (inv. 96.111 to 96.116) and the cast donated by Henri Moissan, one of France's most famous scientists. In short, none of Lacroix's inspected documents mention this large carbonado or its cast. Incredible as it may seem, Lacroix confirms here that he does not understand the heritage value of this cast, despite the fact that it was presented by a great scientist through the French Académie des Sciences, but also because of the specimen it represents, its history or its science.

Comparison with the London models. Furthermore, Robin and Léonie confirm that the Parisian cast is more detailed than the London cast, which came from the workshops of a certain J.R. Gregory & Co and was

manufactured between 1895 and 1902. They are entirely injected with copper (Hansen *et al.*, 2024a). The dimensions of the two London casts - 9.8 x 8.6 x 6.8 cm (Hansen *et al.*, 2024a) - are 2-3% smaller than those of the Paris cast. This represents a volume of approximately 210.50 cm^3, or 7.5% smaller. Hansen *et al.* (2024b) have published a full study of these comparisons, based on my measurements of the scanned files. This study concludes that, overall, the Paris replica is fairly close, although slightly larger than the London casts.

The Paris cast is precious in more ways than one: it is the oldest (along with the one deposited in Salvador, if it really exists) and, it seems, the most accurate in terms of volume, appearance and, even more extraordinarily, weight. As far as I know, it is an astonishing piece of workmanship with an unprecedented result. From then on, this particular cast took over from the lost original and became Sergio's reference. The MNHN inventory was thus updated with the missing keywords for future generations: diamond, carbonado, Sergio, 3167 ½ *karats*, 3245 carats. The morphology of the Sergio de Paris, now confirmed and duplicable without altering the cast, can inform future researchers, in the absence of material, even a tiny fragment. Curiously, the ancients, French or British or otherwise, did not, to my knowledge, see fit to buy back any of the 700 fragments of this specimen after 1902 from Gulland, who did not even donate it to one of the two London museums.

In the interests of openness and better preservation on several sites, a digital copy of the MNHN scan has been given to the NHM in London for study and conservation in their digital collections. In exchange, we received the scans of the London replicas. If a copper cast was to disappear in the future, its virtual memory would be preserved in the form of an electronic e-cast for future generations.

4. Some more *bambúrrios*

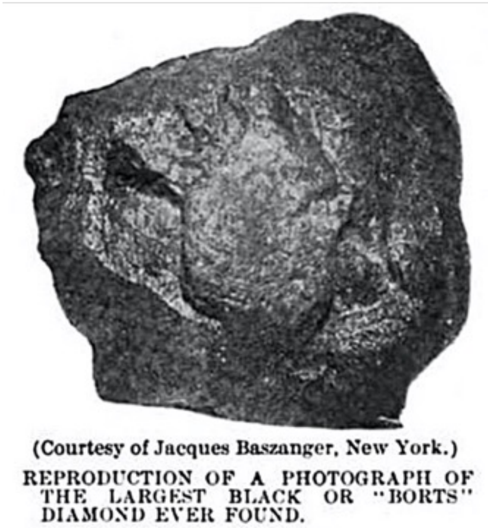


Figure 157. On the left, an engraving taken from Escard (1914, p. 94, compare the weight with the following figure). It is based directly on the one by Thiriat (Figure 111) and is reminiscent of (but not identical to) the plate published in the Bazsanger advertisements (Figure 117). This photograph (right) was published in 1909 in the Bulletin of the International Bureau of the American Republics (28, p. 238). Sources: Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. 110 145 (photograph by the author, on the left) archive.org (on the right).

By a stroke of *bambúrrio*, I found in October 2024 within our archives at the MNHN an isolated and unknown photograph of what looks very much like Sergio. The document is intriguing because it shows a shiny black specimen that does not ressemble the others already known. After months of fruitless searching for hints about its source, I received a second *bambúrrio* blow in January 2025 when I found it, almost by chance, in a book by Escard (1914) on precious stones which, in fact, contains two hitherto "lost" iconographies of Sergio. The first (Figure 157, left) is an engraving obviously inspired by that of Henri Thiriat for Moissan's 1895 article and which had been republished from a previous work by the same author (Escard, 1906). In both of Escard's works, the legend of the specimen indicates a weight of 3080 carats. Later in his second book, Escard publishes a plate of photographs (Pl. XXI) entitled "*Diamants noirs*" (Black Diamonds) in which the Sergio can be recognised (Figure 158). The isolated image had obviously been cut out from another copy of this book, because when both re examinated through a binocular lens, a similar printing

pattern can be observed.

Curiously, the author does not seem to make the link between his engraving (p. 94) and his photograph (pp. 820-821): he even gives different weights (3075 and 3078 *karats*, respectively). But its appearance (colour, lustre, detail) is curiously different from the plates published by Kunz (1904), Aguiar (1904) and Furniss (1906).

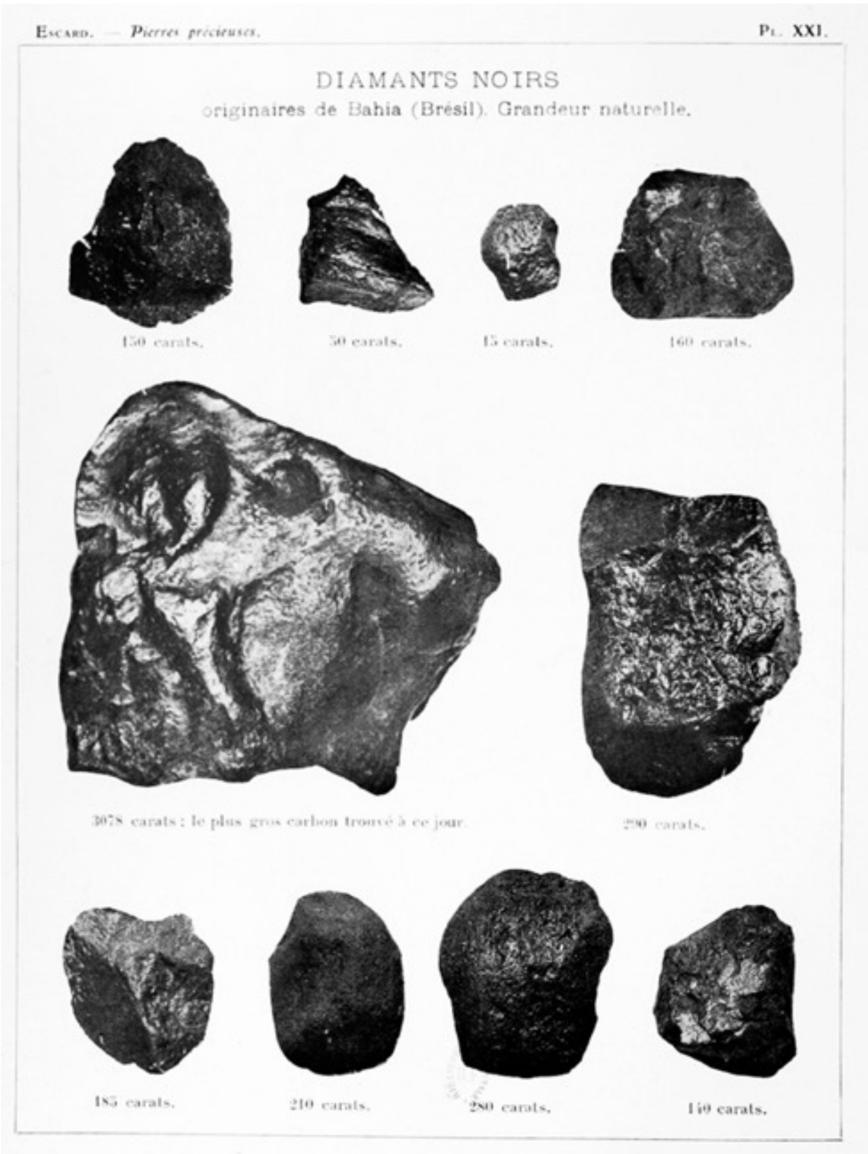


Figure 158. Plate extracted from Escard's work (1914, pp. 820-821) showing a variety of Bahian carbonados, including a very rare photograph of Sergio showing a shinier surface that is less dull or cratered than in the other, more commonly known photographs (Figure 118). Source : Muséum national d'histoire naturelle, Bibliothèque Centrale, inv. 110 145.

In view of the other specimens shown, which differ in lustre, tone, texture, size and weight, this composite document undoubtedly shows a collection of large, genuine natural carbonados. These images are reminiscent in every way of those in the collection of the late garimpeiro Mestre Oswaldo (Meira da Andrade, 1999) and of the carbonado (750.5 carats) broken in 1902 in Germany (Figure 69). The redundancy of comparable specimens on this plate does not make it a scientific illustration, especially as Sergio is referred to as "carbon", which reflects a clearly industrial connotation. When it was published in 1914, the price of carbonados was close to its peak (Herold, 2013). In other words, the value of the specimens depicted on this plate was stratospheric at the time, in the region of €300 million in today's money according to www.historicalstatistics.org. This composite plate therefore seems to be more of a commercial advertisement, which could have come from Kahn (in Salvador or Paris) or Baszanger & C^ie^, who acted as intermediaries between Kahn and Gulland in September 1895.

We had seen that the Baszanger company had published a shot of the great carbonado seen from its other side (Figure 126) in advertising for its New York subsidiary. This shot, although a little greyer than the one published by Escard, is also unsourced. But a second, very similar, but not identical photograph was also published in 1909 (Figure 157, right) in an anonymous article ("Diamonds and their bearing upon the future of Brazil", Bulletin of the International Bureau of the American Republics, Pan American Union, 28 (2), p. 238) with the words "Courtesy of Jacques Baszanger, New York". This ownership mark tends to prove that the company commissioned this photograph (as well as those in their advertisements), which implicates its Paris head office in September 1895.

The graphic similarity between the images from Baszanger and Escard is striking: these three plates show a carbonado that is both deep black and shiny, like the other specimens shown on this plate, which must therefore be a medley of the best carbonados traded by Baszanger.

5. Mathematics of Sergio's images

These ten Sergio iconographies are clearly too heterogeneous, oscillating between deep black, glossy or matt, and semi-gloss steel grey. They were analysed using various mathematical methodologies for classifying and organising images, in order to check whether certain aesthetic dependencies, already visible empirically, had a scientific reality. To convince ourselves of the method, I first compared them with the current photographs of the casts at the MNHN and the NHM (Hansen et al., 2024).

Preliminary calculations show that, despite their differences, the two current photographs of the London casts (NHM1 and NHM2) have been grouped together, not far from those of the originals published by Yawger (1907) and Kunz (1904). In fact, their dark appearance is visually closer to the old photographs published in the United States, in agreement with the descriptions of Moissan (1895a,b) and Gregory (1895) who mention a specimen of a black colour, like many of the carbonados found in Bahia. This dichotomy between the photographs of the casts, which is qualitatively obvious to the eye and linked to the differences in know-how between Paris and London, means that these differences can be quantified in a more mathematically robust way. On the strength of this validation, I carried out the calculation on historical photographs. Their algorithmic classification is presented in the Figure 159.

On the right-hand side of the dendrogram, the historical photographs in De Souza Aguiar (1904), Pereira (1909) and *Bahia Illustrada* (1919) are grouped together, although they are not identical: they therefore come from the same source. The latter is computed to be close to Furniss (1906) and the current photograph of the MNHN cast (2023), despite the century of time and technology separating them. We can deduce from this that these photographs show the same type of object, which can only be the Parisian-made casts of 1895-1896. Therefore, the photograph published by Furniss (1906) and universally recognised as Sergio's (Wikipedia), probably does not illustrate the original, but its 1895 cast, and more precisely that of the IGHB preserved in Salvador where Henry Watson Furniss was consul of the United States of America from 1905. This situation is all the more frustrating given that this

institute has not responded to any of our requests that might have enabled us to find out more.

Hierarchical clustering and dendrography

This Python-based algorithm calculates various methods for classifying and organising images in a hierarchical cluster using different linking methods (WARD, SSIM etc.). These methods evaluate differences in luminance, contrast and structure to calculate pairwise similarities between images, which is then used to build a hierarchical clustering model. The relationships between images ("distance") are visualised using a dendrogram, giving an overview of the structural similarities within the dataset. This approach is particularly suited to the analysis of image sets where subtle visual similarities are nevertheless important, such as fossils, works of art or scientific imagery. These hierarchical classification methods offer an effective tool for exploring complex image datasets whose dendrographic representation enables the connectivity of their graphical similarities to be better visualised from a mathematical rather than a visual point of view. The set of images studied here comprises six historical images of Sergio and three modern images (the three casts currently being studied, since the Bahia cast has not been made accessible). These images, particularly the more recent ones, were converted to greyscale, homogenised in terms of resolution, dimensions and greyscale, then aligned and processed using a Python algorithm. In order to obtain a set of images that are comparable with each other and to reduce the graphic bias of the recent shots, the latter were slightly blurred.

In addition, the algorithm brought the "certified original" images (Kunz and Yawger) together with Escard under the same common branch, despite their significant differences in brightness. The two Baszanger images (1 and 2, published in 1909 and 1911) are carried by a separate branch, due to their different orientation, but remain located on the left-hand side of the

dendrogram. The algorithm confirms that the Escard plate shows the original and that it is linked to Jacques Baszanger, who must have taken several plates of the Sergio, obverse and reverse, before it was resold. The photograph published by Escard (1914) is therefore the most authentically beautiful known to date of the Sergio carbonado, a *bambúrrio* rediscovered and identified in March 2025.

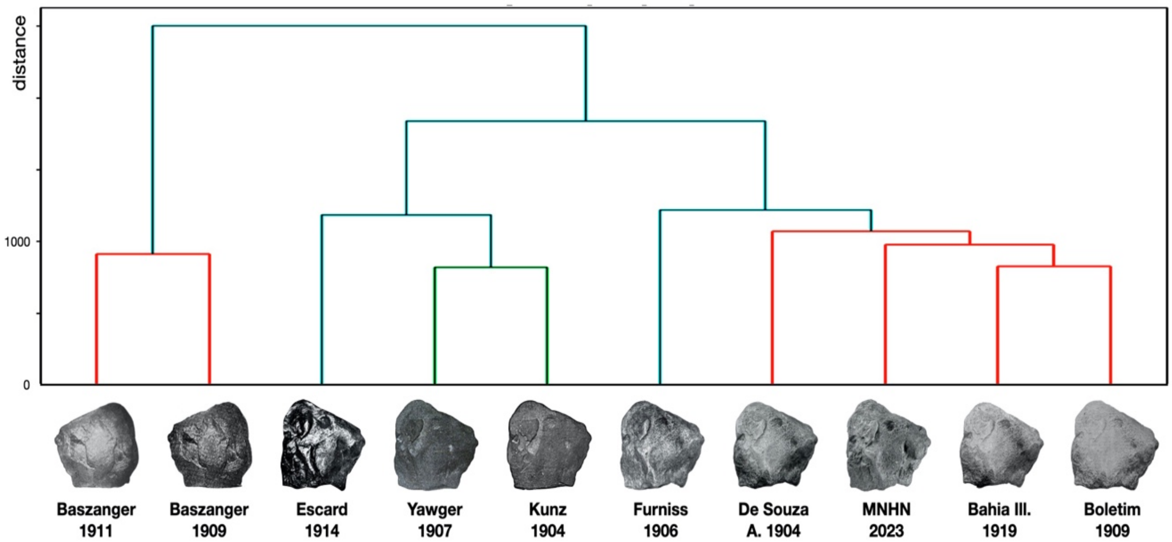


Figure 159. Dendrographic representation, after calculation by hierarchical grouping (Ward method), of the various Sergio images (historical and current, having been standardised in terms of dimensions, resolution and grey levels). Computations and representation: ©François Farges.

6. False pretences revealed?

The dendrogram also explains why Ganem (2001, II, p. 68) states that "*O carbonado de Sérgio, relata João Miranda Neves, figurou na exposição de São Luís, em 1904.*" (Sérgio's carbonado, according to João Miranda Neves, was exhibited in São Luís in 1904; Editor's note: João Miranda Neves was a chemist/pharmacist and renowned historical chronicler of Lençóis and the surrounding area in the years 1908-1917; his manuscripts, collected in three volumes, gathered precious local testimonies, including those related to the diamond rush). In fact, Sergio had already been crushed in London in 1902, so he could not be exhibited at the Universal Exhibition in Saint-Louis in 1904, apart from his replica of the IGHB, which Pereira (1901) actually described as "silver" and not black (Moissan, 1895a,b; Gregory, 1895). Pereira (1909, p. 126) confirms that this object was indeed "*Figurou na Exposição de S. Luiz (America do Norte)*" (shown at the St Louis Exhibition, North America). Furthermore, he adds that it was "*fotografado em seu tamanho natural na Joalheria Kahn.*" (photographed in natural size in the Kahn jewellery shop). The caption of that photograph states that the photograph was obtained through the intermediary of Souza Carneiro (Antonio Joaquim), an engineer at the IGHB and author of a book on the mineral wealth of Bahia (*Riquezas mineraes do estado da Bahia*, published by Reis & Co. in 1908). Souza Carneiro could therefore be the author of the photograph published in Pereira (1909), but also of the articles published between 1904 and 1918, including the one in Furniss (1906), which has since been universally used to depict Sergio Carbonado. These illustrations, almost identical, were most likely made at the IGHB, not on the original, which had already been exported or destroyed, but on the second cast from Paris, after it had been bought from Kahn by the widow Costa Pinto.

On the other hand, the photograph that historical sources mention as having been taken at the *Joalheira Kahn* (Pereira, 1901, 1909) cannot correspond to any of the IGHB photographs (too late), but only to the one produced by Franck Dennis at Coschel Kahn's house at the end of July 1895 (Yawger, 1907). This photograph (Figure 118; bottom right) seems to have been unknown to Brazilian authors at the time.

7. Influence of lights

There are also major differences between the authenticated shots of Sergio, which oscillate between matt (NHM) and glossy (Escard). The answer came to me again thanks to another last-minute stroke of *bambúrrio*: I remembered a technical shot of the Paris cast taken in 2006, shortly after I arrived at the MNHN, using conventional incandescent light sources (diffusing; Figure 160) which show it to be a fairly dull black, as at the NHM. On the other hand, a sunlight-type source (around 5,000 K) captures a detailed texture, as in De Souza Aguiar (1904), Boletim (1909) and Furniss (1906), where the light source appears intense and diffuse.

Figure 160. *The 2006 image compared with the 2023 image of the 1895 Sergio cast held at the MNHN prior to its formal identification in 2023 (the orientation is not exactly the same). Note its dark colour and dull glow (incandescent lighting, around 3,000 K, moderately powerful) compared with my 2023 image taken with powerful solar-type lighting (5,000 K).Photos: © Direction des collections/MNHN and François Farges/MNHN*

For example, the brilliance of the Escard plate (1914) and that used by Baszanger in his American advertisements must be due to the lighting coming from an intense but punctual source, such as a magnesium flash then used for photography in Paris (Baszanger1, Baszanger2 and Escard). This also explains its excellent photographic quality, particularly the resolution of surface details. As for the American shots, they were taken with a light source that was not so intense but diffused, clearly natural light indoors, hence their reduced quality in terms of detail and contrast.

THE CURRENT SCIENCE OF BLACK DIAMONDS

1. Mineralogy

The minerals associated with diamonds, sorted by the garimpeiros and then identified by scientists, are essentially of metamorphic origin. This means that they have undergone fairly significant mineralogical transformations as part of powerful past tectonics, linked to more or less advanced stages of metamorphism, from schists (marked by the presence of staurolite, andalusite, almandine and kyanite) to granulites (corundum). Alongside diamonds, we also find minerals more closely linked to magmatism, such as florencite (and other hydrothermal phosphates such as goyazite, monazite, anatase, rutile, zircon, apatite, hornblende, augite, olivine, chrysoberyl, etc.). There are also minerals that concentrate at the bottom of the mudflats, known as the dense detrital fraction, composed of schorl (one of the tourmaline species), hematite and magnetite (Meira de Andrade, 1999).

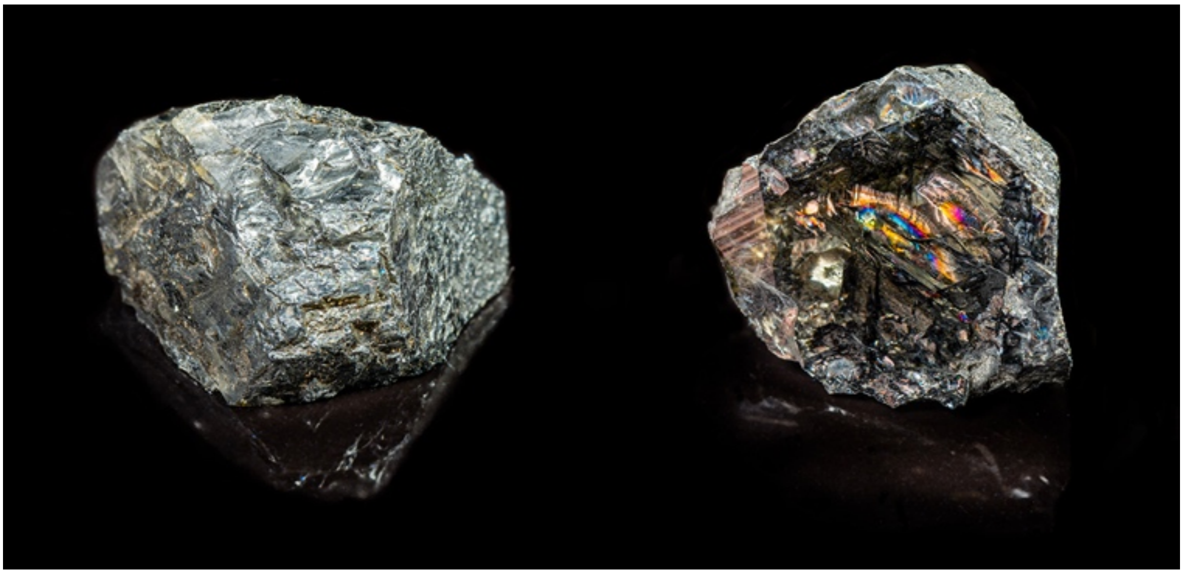


Figure 161 . Single-crystal black diamond (8.66 carats) from Kimberley (South Africa), seen from two sides. On the left, a cleavage makes it possible to glimpse spectacular Newton rings (a light interference pattern producing concentric rainbows) on the surface of the diamond, which is only possible in an optically homogeneous diamond mass that has been partially fractured by a cleavage. 17.7 x 14.1 x 7.3 mm. Paris, MNHN, mineralogy, inv. 200.8. Photo: © François Farges/MNHN.

Between black diamonds and diamonds that look black

There are three main families of black diamonds, distinguished by their crystallinity: monocrystalline or polycrystalline, which can be divided into two categories: on the one hand, mineral and microcrystallised aggregates (bort, ballas and cuboids) and, on the other, diamantites, rocks composed essentially of diamond microcrystals, including carbonados (Figure 1). The former are produced by various mines in Siberia (Mir mine), South Africa and Zimbabwe (Marange). Like Brazil, the island of Borneo supplies all three types (Babinet, 1855; Sun *et al.*, 2005). Single-crystal black diamonds are very variably coloured, depending on the deposit, by inclusions of graphite and/or iron minerals such as haematite or magnetite and even native iron, not forgetting chromite or forsterite (Eaton-Magaña *et al.*, 2019), which implies variable translucency depending on the density of inclusions (Figure 161). Clouds, similar to those observed in Brazilian petal diamonds, can be observed, as well as various crystallinity or irradiation defects. Some black diamonds are actually of a saturated colour (Figure 162), often yellow-brown or even green, which appear black (Figure 163).

Also, there is the new category of “salt and pepper” diamonds, a new commercial product designed to enhance the value of diamonds that are fairly well included, also of so-called industrial quality.

Other “black diamonds”, the majority of small stones produced by today's diamond industry, are not natural: their surface has been deliberately blackened in the workshop, in particular by aggressive polishing that leads to the formation of a layer of graphite on the diamond's surface. These “pseudo-black diamonds” are black only on the surface, hiding in their darkness the “flaws” that jewellers and their wealthy customers cannot see. Originally, they were most often diamonds too rich in inclusions for the jewellery market, like the “salt and pepper” ones. They were once destined for industrial crushing to be used as polishing powder for other gems. While we can be pleased that, this time, the material of these diamonds has not been completely reduced to powder, they remain difficult to study, given their value: once again, most museums are devoid of them.

On the other hand, no minerals related to the primary diamond rocks, such as kimberlites (or lamproites, closely related minerals that specialists are able to differentiate), have been reported in the carbonado deposits, such as

pyrope, ilmenite, olivine, enstatite or even chromiferous diopside and spinel, etc. (Meira de Andrade, 1999). The gem diamonds from this region contain inclusions of these precious indicator minerals (Vilela de Carvalho *et al.*, 2018). This highlights the great multiplicity of origin of alluvial diamonds.

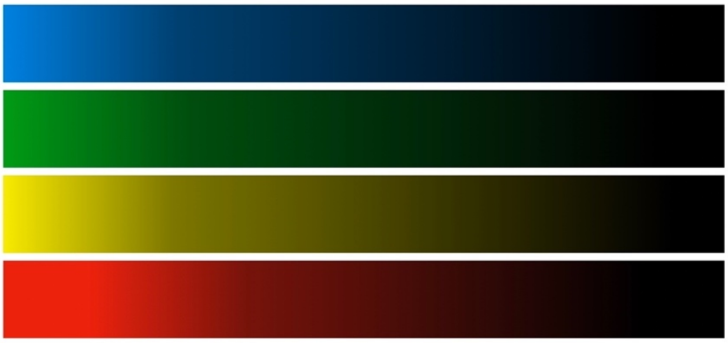


Figure 162. Black can correspond to an infinite number of hues, of which four primary colours are shown here on the left, which can be saturated (right-hand side).

Figure 163 . Three monocrystalline black diamonds (3.4 carats) with a saturated colour: green-brown, yellow-brown and green (two images on the right). The last image shows the previous diamond but under backlighting, which highlights its magnificent deep green colour that does not appear clearly in incident light (third image). Paris, MNHN, mineralogy, inv. MIN000-2690. Photo: © François Farges/MNHN.

Carbonados often have a "vitrified" outer patina linked to the presence of nanocrystallites on the surface (Kaminsky *et al.*, 2013; Haggerty, 2017). Their surfaces are sometimes striated due to high-pressure sliding (shearing), as in a fault plane, but between carbonados. More recently, various studies on carbonados have investigated the question of their fine mineralogy, using cutting-edge methodologies (microscopies, isotopies). For a long time, this research was limited by carbonado's extraordinary resistance to scientific preparation (sawing and polishing): the advent of powerful lasers in the 2000s not only enabled faceting, but also quantitative microscopic studies. A ceramic-type polycrystalline matrix can be observed, but composed of diamond

crystallites, very often xenomorphic (with no emblematic crystalline form) and with two size ranges: fine (<1-20 µm) and coarse (20-100 µm). Meira de Andrade (1999) and others have also detected the presence of minor quantities of phosphates such as florencite (([(Ce,Nd...) Al_3 (PO $)_{42}$ $(OH)_6$], trigonal). Shcheka *et al* (2006) describe samples from the Lebedinoe goldfield (near Aldan in the Republic of Sakha, also known as Yakutia). They show a gem diamond/carbonado association associated with a paragenesis sporadically enriched in rare metals (native iron, titanium, aluminium, chromium and tin!). Rare millimetre crystals punctuate this porphyry-type microtexture (Sautter *et al.*, 2011; Haggerty, 2014; Ferreira, 2020).

The MNHN collections contain a similar specimen (Figure 164) in which Rondeau *et al* (2008) and Sautter *et al* (2011) detected rare native metals associated with more mantelic phases, such as phlogopite in addition to florencite. The gem part shows monodirectional, palisade-like crystal growth. Its yellow colour is locally orange to red due to diffuse hematite inclusions and even an automorphic black single crystal (which is extremely rare in a diamond). This type of composite sample was not new: Boutan (1886, p. 90) had already pointed out in his time (translated): “Finally, the Borneo mines contain a fairly large number of diamonds with a core of boort or carbon enveloped in a layer of well-crystallised colourless substance”. Another example : an anonymous journalist published in 1908 an article entitled “*Exposição Nacional de 1908: Diamantes da Bahia*” (*Boletim*, *Directoria da Agricultura Viação Indústriar Obras Públicas* BA, 4-6, p. 175) about a presentation at the forthcoming national (Brazilian) Exhibition of Bahia diamonds of various types (translated): “white, brown and black ballas, different types of boarts: rare stones - carbonados inlaid with natural diamond, diamonds in whimsical shapes - a tooth, a foot, an elbow, a pen, a stick and others.” So, as incredible as it may seem, not only have these specimens gone unnoticed by ancient scientists, but so have these references by today's researchers. Since the 1850s, many of such composite specimens have been found, especially in Bahia, but only one preserved (at the MNHN). As with the carbonados, the conservation of such amazing specimen was possible in the 1850's because the industry was not yet ready to destroy them all.

Other studies of carbonados (Baumhauer, 1881; Ketcham and Koeberl, 2013) point in the same direction. The study of another Bahian carbonado (Ferreira, 2020) indicates that it is composed of diamond (62.7%), goyazite ($SrAl_3(PO_4)_3(OH)_3$ - H_2O, also trigonal, 14.5%) and florencite-(Ce), 11.9%). The remaining 10.8% is related to porosity. This study shows that 59% of the diamond micro-grains in this carbonado are quasi-structured (highly crystalline with large grains), 24.5% are recrystallised and 16.5% are deformed (areas with smaller grains). The phosphates have crystallised epitaxially (i.e., following specific crystallographic orientations) on diamond.

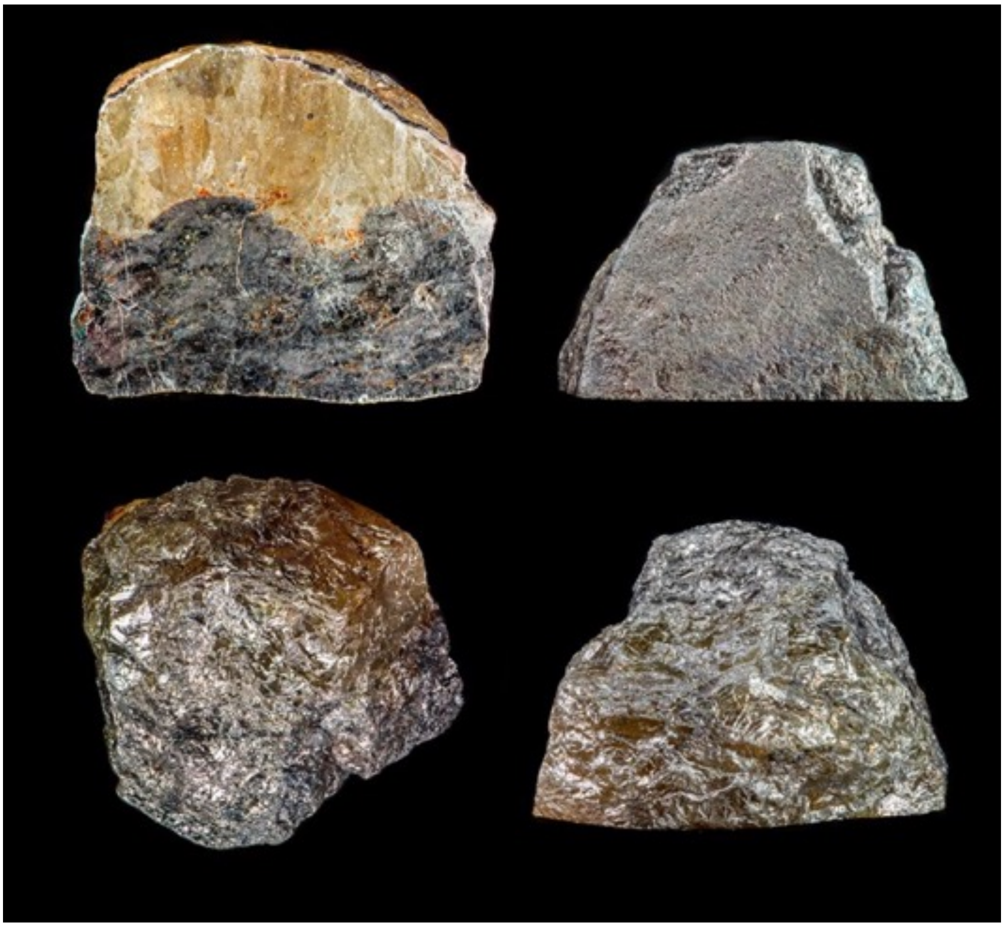


Figure 164 . Four views (front, bottom, back, top) of the carbonado-diamond composite which was sawn in two (here, part A) and of which the other part is studied by Rondeau *et al.* (2008) and Sautter *et al.* (2011) as inv. 107.823: however, this rib corresponds to other specimens, perfectly labelled (See Figure 84). The inventory suggests that it is more likely to be the composite diamond inv. 51.149 inventoried and described by Dufrénoy (1856, II, p. 96). Its inventory number, necessarily written in red, has unfortunately disappeared, suggesting that it has since been erased. The lower part (top right) shows a classic carbonado surface (porous and dark grey with a greasy sheen). Photos: François Farges/MNHN.

An exceptional diamond-carbonado

Rondeau *et al* (2008) and Sautter *et al* (2011) studied a sample, announced as unpublished, showing a diamond-carbonado association (Figure 164) similar to those described by Shcheka *et al.* (2006). It is described as inv. 107.823: however, this number corresponds to other samples (Figure 84). The XRF analyses show many differences between these specimens for them to have been broken from the same original volume. Conversely, this diamond-carbonado is most reminiscent of the specimen already described by Dufrénoy (1856, II, pp. 96-97) as (translated) "showing the passage from crystallised to compact diamond [...] It is a kidney broken more or less in the middle and weighing 2 gr. 11; it is composed of two distinct parts, the outer zone is black with a resinous cleavage, the central core is crystalline, hyaline and lamellar like diamond; these two parts, although different, offer an insensible passage between them, and the lamellae of the cleavage melt into the paste; this kidney is covered with the black crust which always exists on the surface of this variety of diamond". Apart from measurement errors, the weight corresponds to that given by Rondeau, i.e., 2.12 g. But alas! Dufrénoy does not give its inventory value. However, the reference inv. 51.149 – which remained untraceable in the drawers at the time – corresponds best (translated): "Compact blackish brown diamond associated with crystalline diamond / weight 2g25 : 10 karats ¼ / the compact part is at the outer part of the sample / this arrangement makes us suppose that this ech.[antillon] is a fragment of kidney / Brazil / M. Ravergie / 160 f[rancs]". The donor was explorer and MNHN correspondent Jean-Marie Ravergie. The recorded weight appears to be 0.13-0.14g (+7%) higher than that reported by Dufrénoy and Rondeau. However, the second weight, given in karats (old Parisian karats), is equivalent to 2.10 grams, suggesting that the indication "2g25" is a copying error. In the carbonado volume, note the presence of a bedding and the presence of more orange-coloured gem enclaves (linked to ancient haematites, of which a single crystal exists as an inclusion in the gem part, which is extremely rare for a diamond). Both indicators suggest a strong tectonic component. Finally, the presence of yellow-orange diamonds, microscopically tending towards vermilion, may be linked to the extremely rare red diamonds known, mainly from Brazil.

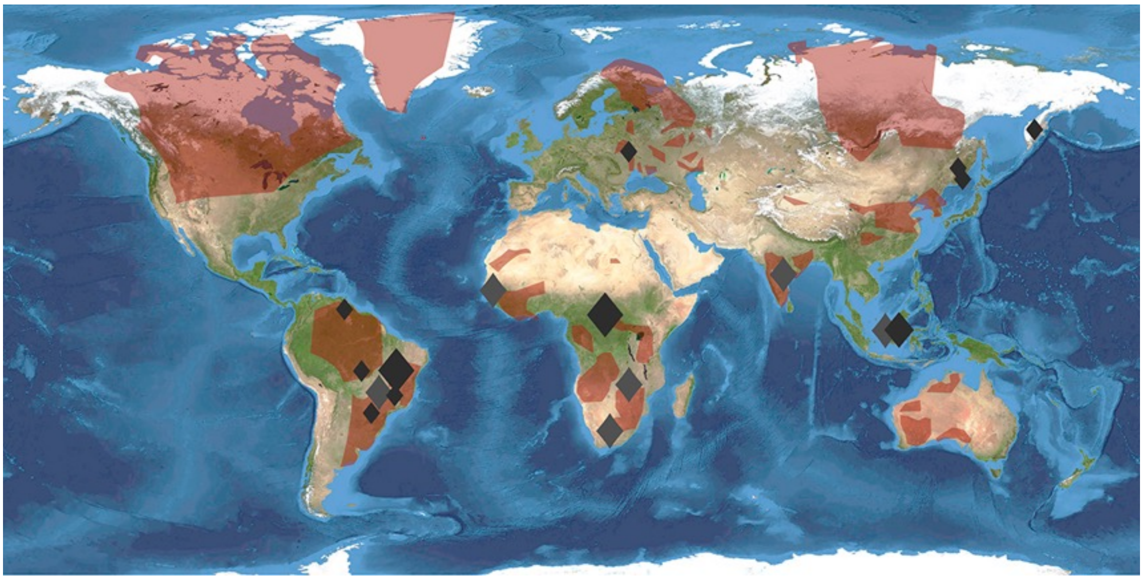


Figure 165 . Map of the main deposits of (◆) carbonado (and pseudo-carbonado in Kamchatka) and monocrystalline black diamond (◆) according to their productivity (size of the symbol) on a geographical background highlighted by ancient continental cratons (in translucent reddish). Sources: Wikimedia Commons and mindat.org (modified from certain localities).

2. The geological cradle

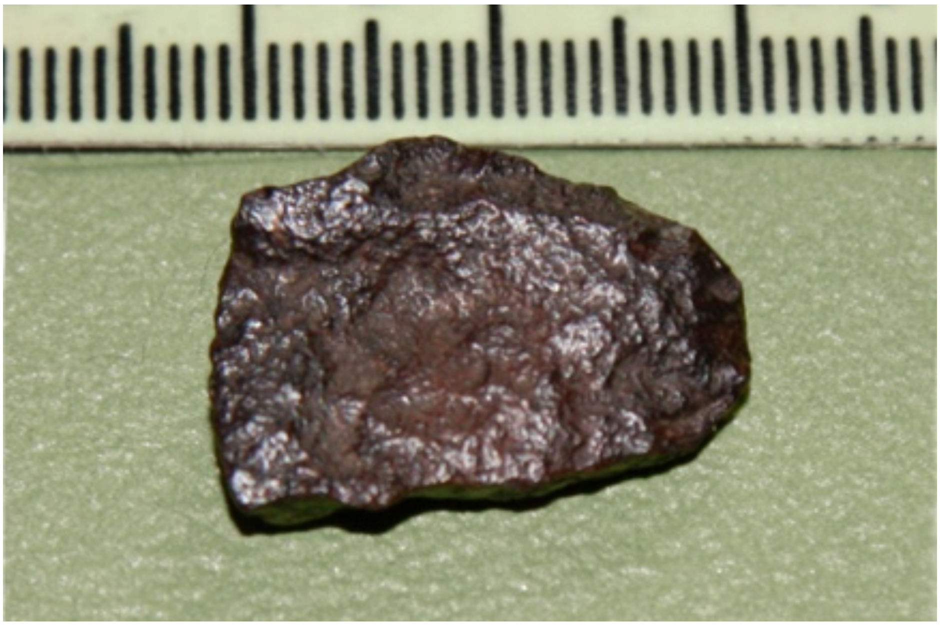


Figure 166. Centimetre specimen of carbonado found at Voronezh in the European part of Russia. Source: Dmitry Maltsev (Russia)/Wikimedia Commons.

Carbonados from Bahia have been compared with those from other Brazilian states (Mato Grosso, Minas Gerais, Paraná) and elsewhere (Figure 165), such as the Central African Republic (especially around the western deposits near Carnot), the other major deposit discovered in the 1925s. They have also been reported in Venezuela (Icabarú, Surukún river valley), Indonesia (Landak, Kalimatan/Borneo), in Russia (in Voronezh, Figure 166, in the European part and, in Eastern Siberia, in the Kamchakta and Primorie krai and the republic of Sakha). The geochemical properties of all these carbonados are similar from one deposit to another (Haggerty, 2017). Their age is between 3,800 and 2,600 million years (hereafter, M.y.) on the basis of their lead isotope radiation. However, on average they are Archean in age (Figure 167) and therefore predate the oldest known single-crystal diamonds, which are dated at 3,500 million years ago in Canada (Westerlund *et al.*, 2006). Magee *et al* (2016) have shown that carbonados were enriched in uranium during the Palaeoarchean period (between 3,600 and 3,200 million years ago), leaving traces of irradiation that are still visible today in some samples. The uranium was then demobilised in the Mesoproterozoic (1,600 to 1,000 million

years ago), suggesting the presence of oxidative environments (only the "oxidised" uranium, known today as hexavalent, can be mobilised in the form of uranyl, which is soluble in water).

The other question that is currently agitating mineralogists concerns the comparative geology of carbonados, Brazilian and others, in relation to single-crystal diamonds. In the state of Bahia, miners have extracted diamonds from gravels in mountain diaclases or river sediments. However, to my knowledge, very few representative samples of diamond-bearing rocks in place and before processing have been preserved (except these at the MNHN; Figure 50). Many older authors have extrapolated the geology *of serviço de rio* with that of *serviço de serra*: the designation "conglomerate" being applied to both Proterozoic metaconglomerate and Cenozoic *cascalho*, in particular the sub-actual indurated *canga* form that forms all the known samples in the MNHN collection (Figure 45).

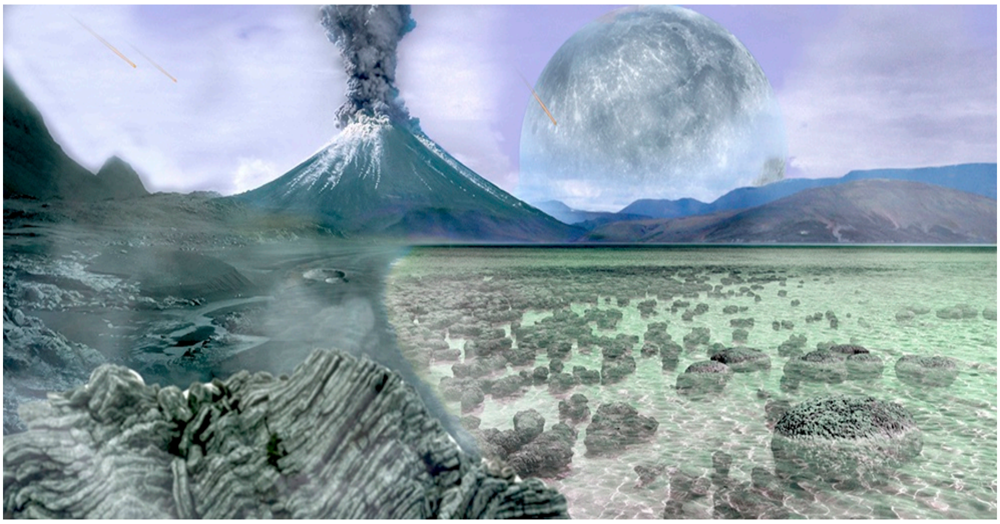


Figure 167 . A pictorial representation, based on current scientific data, of the Earth's surface during the Archean Period (more precisely the early part of the Eoarchean Period, between -3800 and -3100 Ma) when carbonados were formed (on Earth or in space). At that time, the Moon was very close to the Earth, inducing gigantic tides. Volcanism and meteorite falls were very frequent at the time and a few continental masses were beginning to emerge from the oceans. In the latter, researchers currently believe, on the basis of fossilised textures, that the first forms of life, cyanobacteria, formed reefs in shallow areas, known as stromatolites (right), which developed and later helped to oxygenate the atmosphere. Credit: © Tim Bertelink (Creative Commons Attribution-Share Alike 4.0 International) modified by the author (colours modified by virtue of the lack of oxygen at the time: sky changed to a purplish hue and seawater turned green because of the solubilised iron. Furthermore, it is not certain that the type of eruption illustrated (explosive) is correct, as plate tectonics was not yet active.

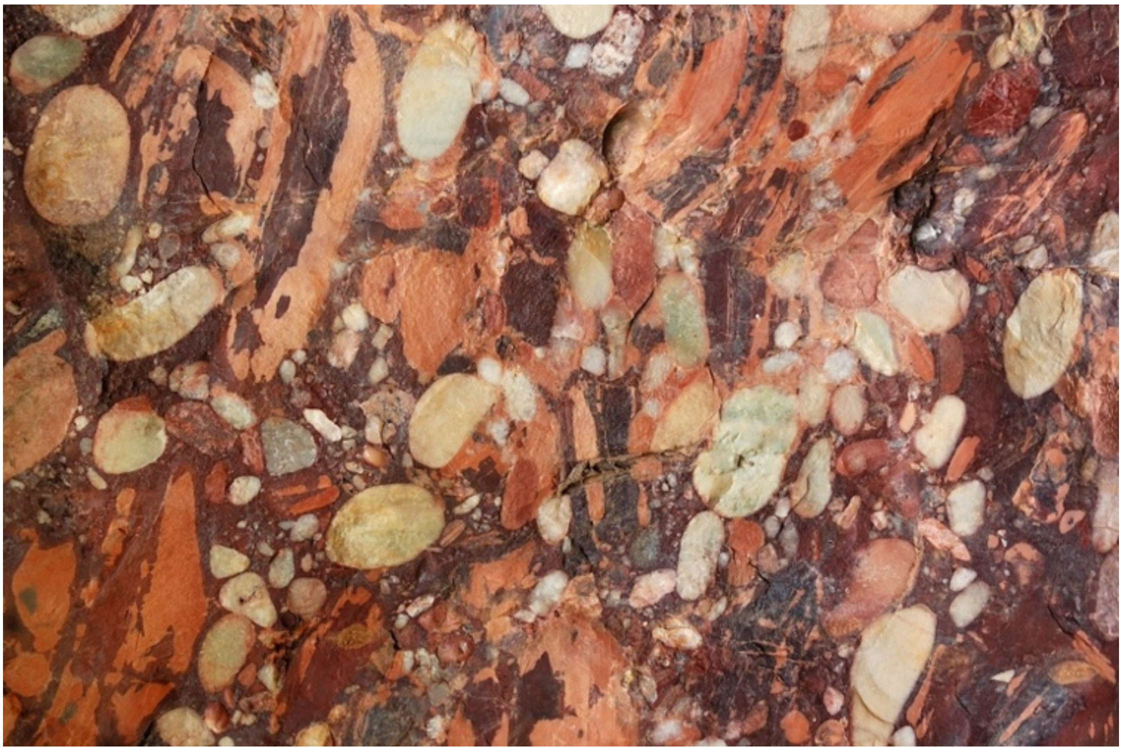


Figure 168 . Detail of the polymictic metaconglomerate (with heterogeneous pebbles) of the Tombador Formation outcropping in the northern part of the town of Lençóis. Credit: © Rosino (Creative Commons Attribution-Share Alike 2.0 generic licence).

In addition, during a trip to the Grão Mogol region (Minas Gerais), Gorceix collected a “diamond in place” (Gorceix, 1881), i.e., a crystal set in a compact rock extracted from a large rock mass (unlike the loose, scattered gravels of the *cascalho*). The rock is an itacolumite, a quartzite with fuchsite (an ancient siliceous sandstone compacted and partially recrystallised by metamorphism that also contains green chromiferous mica): this researcher saw in it the primordial rock of the Minas Gerais diamonds (Figure 168). However, in his later writings, the mineralogist oscillated between a version that implied itacolumite and another interpretation (Gorceix, 1883) that referred instead to an “ancient conglomerate”, i.e., a metaconglomerate. This hypothesis was shared by the Brazilian geologist Derby (1906, 1907), who also understood the magmatic nature of South Africa's primary diamond deposits (Derby, 1896). But he persisted (wrongly) in seeing in Brazilian diamonds an origin other than kimberlitic: for him, it was more comparable to that of native gold, i.e., a hydrothermal origin. It was not until recent years that the first kimberlite pipes in Brazil were identified, some of which are actually

diamondiferous and even mined as in Braunà (Nordestina, Bahia).

Figure 169 . A very rare sample (and original label) of diamond crystal – marked by the red arrow – in itacolumite, a variety of flexible sandstone with chromiferous muscovite (fuschite) but rather resembling quartzite. Specimen (W x H): 2.9 x 2.2 cm. Gift of C.H. Gorceix, 1882. Paris, MNHN, mineralogy, inv. 82.134. Photo: © François Farges/MNHN.

There has been much confusion (even recently: see Svisero *et al.*, 2017) between all these conglomerates (meta- and neo-), which are so different in age and mode of formation. Since then, diamonds and carbonados have been said (Pedreira, 2002; Magee *et al.*, 2017; Svisero *et al.*, 2017; Lima, 2018; Ferreira, 2020) to come from conglomerates with sandstone lenses of the so-called Tombador formation (named after another Bahian serra located further to the north-east). For a long time, this seemed to be the only possible correlation. However, few observers – if any, to my knowledge – have actually observed

diamond in this particular metaconglomerate, although it varies enormously in composition: oligomitic (with monochromatic pebbles) at Mucugê or polymictic (heterogeneous) at Lençóis (Pedreira, 2002; Figure 168).

Itacolumite

Itacolumite is officially a variety of sandstone that forms slabs that, surprisingly, are quite flexible: they can be deformed as easily as a resin despite being composed of quartz, a relatively hard mineral (hardness of 7 on the Mohs scale). It takes its name from its original deposit around the Itacolomi peak (1772 m, Parque Estadual do Itacolomi) a few kilometres south-east of Ouro Preto (Minas Gerais). It contains inclusions of muscovite mica, long thought to be the source of its flexibility. In truth, the latter is explained by a particular porosity. The other enigma surrounding itacolumite links it to the diamonds of Minas Gerais. In the 1880s, the French mineralogist Claude-Henri Gorceix, then director of the School of Mines in Ouro Preto (Minas Gerais, Brazil), collected various samples of itacolumite containing diamond crystals. This was a sensational discovery, as it was the first time that diamonds had been found in an ancient hard rock and not in more recent gravel (*cascalho*). The MNHN has one of these extremely rare samples, which was donated by C.H. Gorceix (Figure 169). Gorceix developed a model for diamond formation in these quartz rocks. However, this model was quickly discarded when it became clear that diamonds were actually associated with kimberlite-type magmatic rocks, first observed in India (at Panna) and then in South Africa (Kimberley, etc.). In fact, while these sandstones are secondary rocks whose erosion fed the more recent gravel pits (*cascalho*), they are themselves also of detritic origin i.e., formed by the erosion of pre-existing rocks dating back 2 billion years. The diamond crystals, thanks to their high hardness and chemical resistance, were transported from rock to rock before being trapped in itacolumite. As diamond-bearing magmatic rocks do not contain quartz, this diamond-bearing sandstone has at least two different origins: crustal and mantle magmatic rocks for quartz and diamond respectively. Since then, diamondiferous kimberlites have been discovered around Barra dos Mendes and even mined in Brazil, including at Braunä (Nordestina, Bahia; Nannini *et al.*, 2017). Conversely, no carbonado has been found “in situ”.

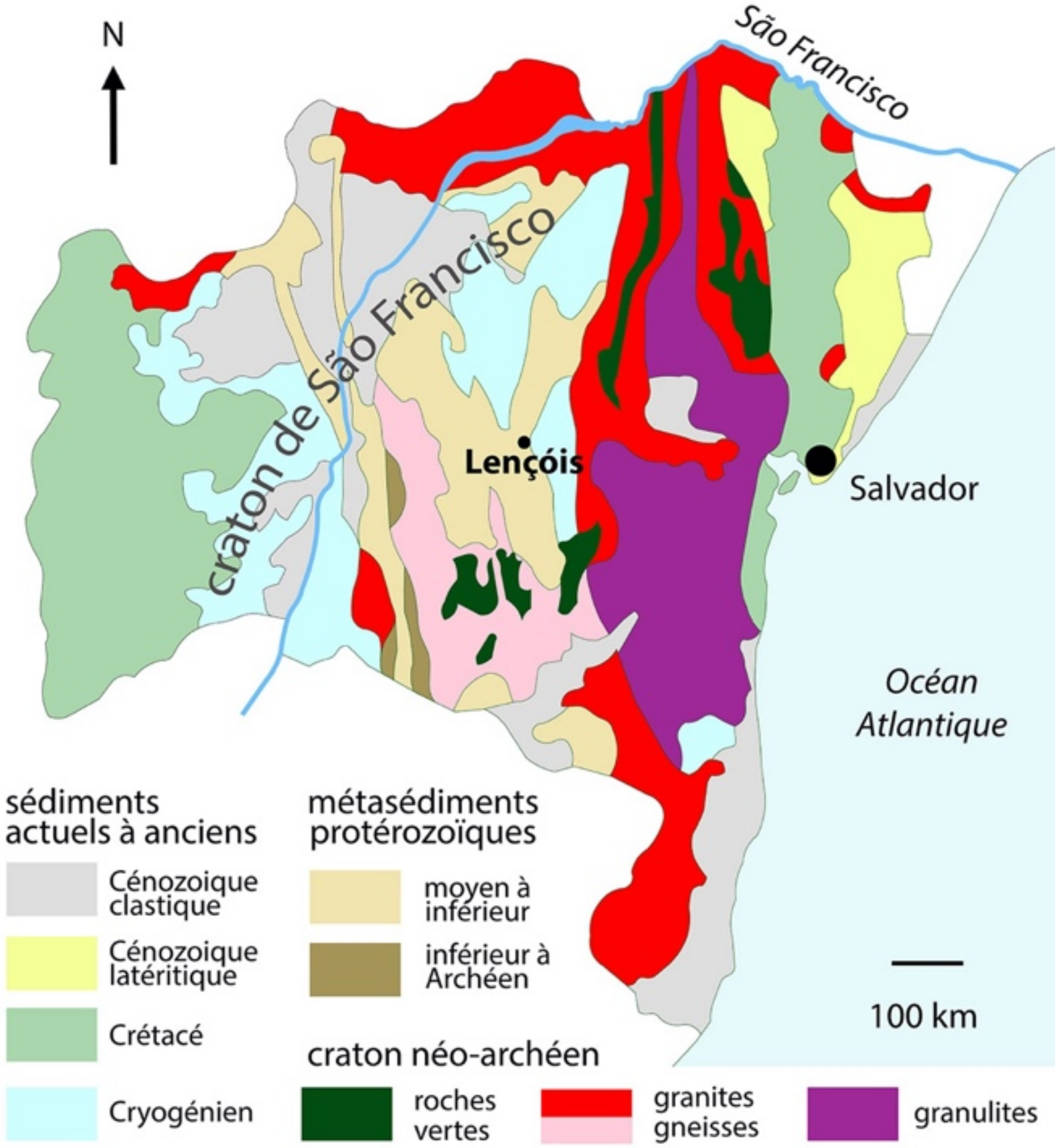


Figure 170 . Simplified geological context of the Brazilian state of Bahia and the São Francisco craton (crystalline base: pink-red-purple-brown-dark green), once connected to the Congo craton in Central Africa (from Gondwana onwards), then separated by the opening of the Atlantic Ocean. Map redrawn by the author after simplification of various maps from the Brazilian Geological Service, 2003.

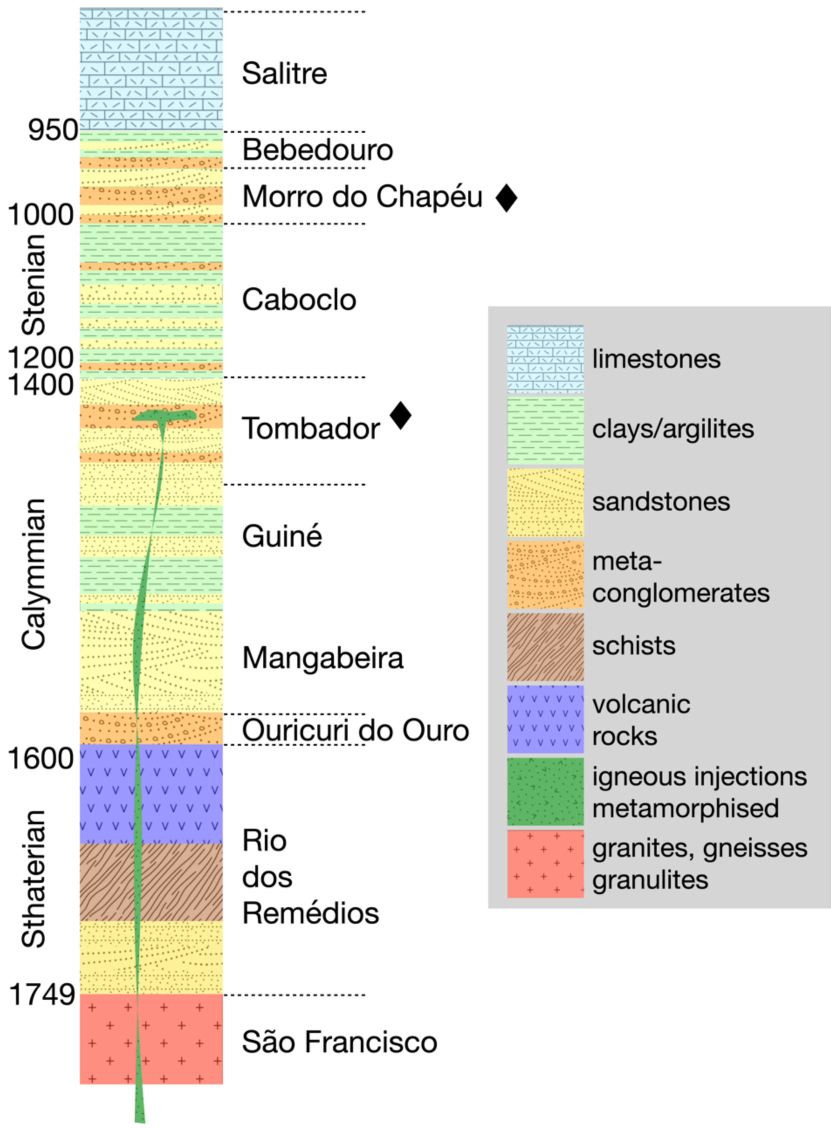


Figure 171 . Schematic representation of the stacking of different rock layers in the Lençóis region, from the São Francisco craton (crystalline rocks, in red) at depth (bottom) to the terminal Proterozoic limestones (top). These layers, which vary in thickness from a few centimetres to more than 20 metres, are grouped together by geologists into formations, including that of Tombador. The age of the rocks that have been dated is shown on the left in millions of years. Note the injection of igneous rocks (in green) from deep underground (upper mantle) through dykes (chimneys) that pierced the Archean formations up to the Tombador formation. These cooled magmas were then strongly metamorphosed into martite phyllites which, according to Battilani *et al* (2007), supposedly contain microdiamonds (symbolised by black diamonds) that may have been the geological source, after intense alteration and leaching over more than 1,000 million years, of the diamonds in the historic Chapada Diamantina deposits. Simplified diagram based on Battilani *et al* (2007), Pedreira (2002) and Magalhães *et al* (2014).

These rocks outcrop in the central part of the state in NNW-SSE trending tectonic folds set in a basement, the São Francisco craton (Figure 170). This craton, a very old continental fragment, is made up of so-called "crystalline" rocks such as granites and gneisses, as well as "green rocks" according to the current nomenclature used by geologists (except that a green rock is not necessarily what geologists call a "green rock"...). These peculiar "green rocks" are formed by a complex alternation of volcanic and sedimentary rocks that once lined the ocean floor and have since been metamorphosed into a variety of schists that are generally rich in green minerals such as chlorite, actinote and other amphiboles.

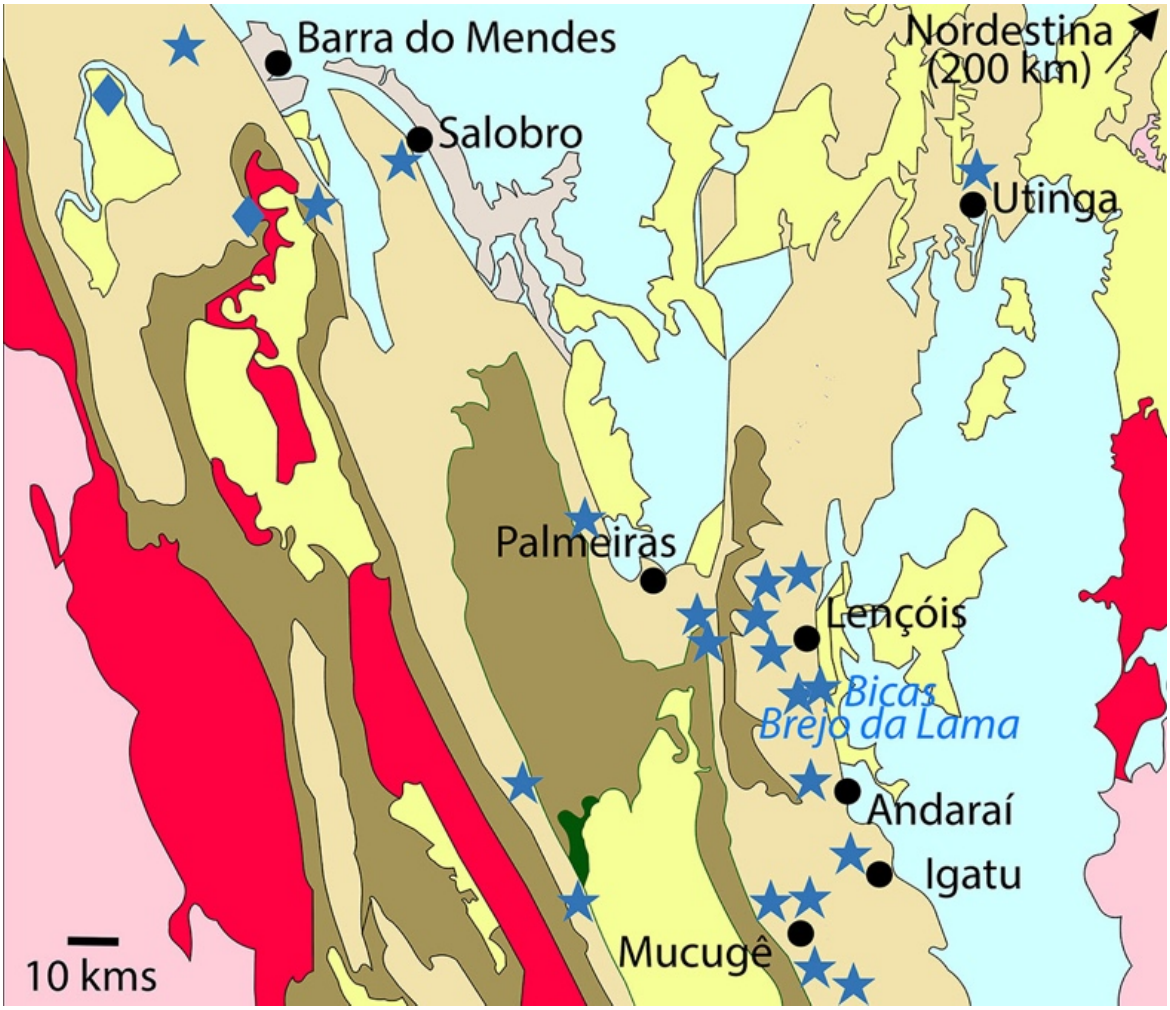


Figure 172 . Detail of the geological map of the Chapada Diamantina diamond-bearing region: the main diamond deposits are marked in blue: diamonds (primary kimberlites) and stars (secondary deposits, from Mesoproterozoic metaconglomerates to subactual sediments). Map redrawn by the author after simplification of the numerous studies mentioned in the text.

In particular, the Chapada Diamantina is characterised by detrital Proterozoic rocks, mainly siliceous and clayey, composed of complex alternations of conglomerates, sandstones and clays, deposited on the São Francisco craton and crowned by brecciated limestones (Figure 171). The diamond deposits, both old and more recent (Figure 172), follow these rocks of the Tombador and Morro do Chapéu formations.

In the Lençóis region, Battilani et al (2007) discovered “veins” of phyllites, metamorphic rocks intermediate between slate and micaschist, rich in sericite, muscovite and “martite” (a hematite that was previously a magnetite, i.e. two iron oxides that are easily distinguished by their different physico-chemical properties and therefore atomic arrangements). The majority of the phyllites collected and analysed revealed traces of an ancient volcanic texture, as well as cubic minerals rich in carbon, interpreted as microdiamonds. They also deduce that these phyllites are derived from the metamorphism of ancient volcanic rocks (linked to trachytes) whose presence of these probable micro-diamonds indicates a deep mantle origin, at a depth of more than 150 kilometres. These haematitic phyllites are also known from the diamondiferous Diamantina region in Minas Gerais, where Bezerra Neto (2016) more precisely detects the affinity with lamproites, water-rich potassic magmatic rocks that are sometimes diamondiferous, as in Australia (Argyle) or in the Indian subcontinent, where they appear to be the origin of “Golconda” diamonds (Chalapathi Rao *et al.*, 2010).

More generally, lamproites are volcanic rocks that erupt on the surface. They are very similar to kimberlites, which are also found in India and especially South Africa (among many other countries) and which form the matrix of the vast majority of diamonds currently mined. Both form in the Earth's mantle at depths of more than 150 kilometres. These rising magmas act like high-speed “diamond lifts” (10 to 30 metres per second, or more) that, in their rush, pull these crystals out of the Earth's mantle and inject them further into the surface, as in the Tombador conglomerates through these “veins” that are, in reality, dykes, the feeder chimneys of these volcanic edifices. After cooling, all these rocks were metamorphosed by various subsequent geological events: the Precambrian conglomerate became a metaconglomerate

(compacted and recrystallised) and the lamproite, martite phyllites. These Brazilian hematite phyllites with lamproite affinities may therefore be the original sources of Brazilian diamonds, of which the Minas Gerais diamond itacolumite – once collected by Gorceix – must be one of the products of Precambrian alteration.

The study by Battilani *et al* (2007) seems to me to be the only one to have detected microdiamonds in the Tombador formation, reputed to be diamondiferous on the basis of indirect geological intersections. Unfortunately, this study – which does not specify which deposits have revealed microdiamonds – announced other promising results that have unfortunately not yet been published. Since this first encouraging publication, I have not found any other research undertaken in this direction to clarify these discoveries, in particular the formal identification of microscopic cubic carbon phases (which we do not believe to be contaminations during the preparation of these samples). These identifications are currently easy with a micro-Raman spectrometer. They would make it possible to check whether these carbon phases are indeed natural diamonds or even carbonados. While the mantle origin of terrestrial gem diamonds is less and less in doubt among scientists, even in Bahia, that of carbonados remains to be confirmed.

In addition, primary diamondiferous rocks derived from the Earth's mantle, such as kimberlites, are known further west, in the Chapada Velha, south of Barra do Mendes, around 120 km north-west of Lençóis, along with associated alluvial deposits, including those at Salobro (Figure 172). These secondary deposits belong to the Morro de Chapéu diamond formation, which is several hundred million years younger than the Tombador formation (Figure 171). Nevertheless, no carbonado has ever been found there, despite the millions of tonnes extracted.

3. Reconstructed chronology (to date) of events

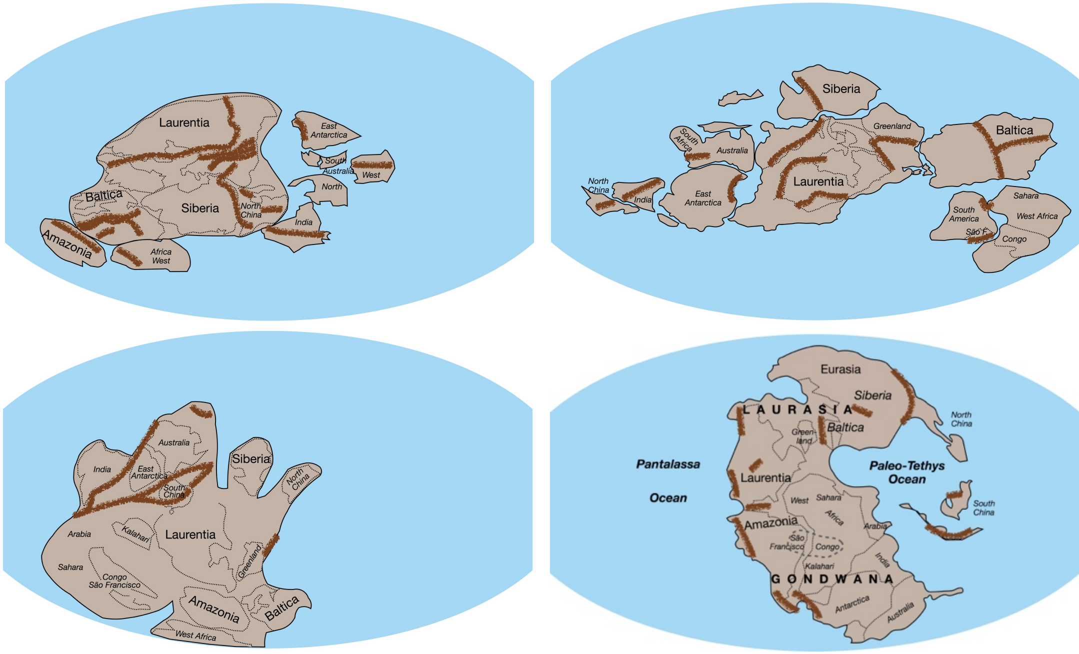


Figure 173 . Model of the evolution of terrestrial supercontinents according to certain recent models (from left to right and top to bottom): (1) during the Transamazonian orogeny (2000 million years ago), which formed the São Francisco craton from pre-existing blocks; (2) then within the hypothetical supercontinent Columbia (1600 million years ago, with the intracratonic deposition of the bedrock of the Tombador diamond formation); (3) then during Rodinia (900 M.y.) and, finally, (4) that of Pangea (200 M.y.). These drawings illustrate the tectonic drift of the most important continental portions (dotted lines with names in italics), the location of the main mountain ranges (dark brown) and the formation of the São Francisco craton (dashed lines) common to the Afro-Brazilian carbonados before the opening of the Atlantic Ocean. The Laurentia, Amazonia and Baltica palaeocontinents correspond to the North American, Amazonian and Scandinavian (north-eastern Europe) cratons. Author's simplified diagrams based on published literature and despite certain controversies, especially in the earliest times (1 and 2).

Two isolated continents appear to have formed during the Neo-Archean (around 2 600 million years ago, a.d.), those that would form the so-called "São Francisco" and "Congo" cratons (Figure 173). As a result of continental drift, they collided around 2,100 – 2,000 million years ago and formed a mountain range at their suture: this is the Transamazonian (American) or Eburnian (African) orogeny. They formed a palaeocontinent, known as the "São Francisco-Congo" paleocontinent, during the Staterian (1800-1600 million years ago), possibly as part of the hypothetical supercontinent Columbia (also known as Nuna), Figure 173). This orogeny led to metamorphism, which affected the sediments of the craton, but also to mountain surrection, which

was immediately attacked by erosion.

New sedimentary layers were deposited, including the Tombador (meta)conglomerates, which were piled up in an intracontinental sedimentary basin i.e., located within the palaeocontinent rather than on its periphery. This intracontinental zone then appears to have thinned as a result of a reverse movement: instead of colliding as in the Statherian, an extensional tectonic is felt at depth. A depression then began to form in this part of the paleocontinent, forming what geologists call a "rift", or collapse trough if the extension had persisted (as in the East African rift running from Djibouti to Mozambique via Ethiopia and forming the Afar depression). However, this extension came to a rapid halt before the formation of the rift itself, which was aborted (what geologists call an "aulacogen"). This pre-rift continues to be filled with the sediments of the future Tombador Formation of Mesoproterozoic age, i.e., between 1,590 and 1,400 M.y. (Calymmian and Ectasian periods). These deposits include an intermediate sequence (known as diamantiferous) made up of terrigenous rocks including (meta)conglomerates (with clasts of milky quartz and/or quartzite and/or psammite) intercalated with arkoses, with criss-cross stratifications. This indicates that these sediments formed in continental environments dominated by deserts (alluvial, fluvial and eolian fans) and then transitional environments (deltaic, estuarine and coastal) on the continental margin, i.e., in contact with oceans (Pedreira, 1997). Other younger sediments, from the Neoproterozoic (between 1,000 and 538 million years ago), overlie the Tombador sediments. These are gradually being buried and transformed into meta-sediments, i.e., sediments undergoing metamorphisation (compaction, recrystallisation). In addition, kimberlites (and possibly lamproïtes as well) that are virtually synchronous with the metaconglomerates (1440 million years ago) rise up from the depths and form pipes, some of which are diamondiferous, particularly towards Barra do Mendes or Nordestina, 200 km to the north-east (Figure 172).

Little geological activity can then be traced for 1,000 million years, in relation, for example, to the formation of the next supercontinent, Rodinia. This is because continental drift creates cycles (known as "Wilson cycles") that alternate between various continents coming together to form a single, gigantic

supercontinent, followed by the break-up of this supercontinent (and so on; we are currently living through a break-up phase that should convert back into a supercontinent in 50 to 100 million years' time, although there are various scenarios to date due to the great uncertainties surrounding the future evolution of terrestrial continental drift).

Figure 174 . One of the most emblematic views of the high plateaux of the Chapada Diamantina, seen from the Morro do Pal Inácio with, in the foreground, various forms of silicokarst erosion in which some rare but large diamonds were found, but further south, towards Andaraí. Credit: © Cesar Vieira (Wikimedia Commons licence, Creative Commons Attribution-Share Alike 4.0 International; slightly cropped and desaturated).

Towards the end of the Neoproterozoic, at around 600 million years ago, the São Francisco craton was attached to the Gondwana supercontinent as a result of the Brasiliano orogeny, which generated a system of major regional folds running east-west from NNW to SSE, including the Pai Inácio anticline, which forms the Serra do Sincorá. Since that time, this serra – along with the others of the Espinhaço formation – has been progressively eroded, particularly in the Cenozoic, when the present-day rugged relief that is so famous (Figure 174), reminiscent of the tepuys of the Guyana Plateau. This erosion created a silicoclastic parakarst (some call it a “pseudokarst” because it is not carbonate-bearing as an “official” karst) linked to the humid equatorial climate, which favoured more significant dissolution of the silica (Souza *et al.*,

2021; Figure 175). The detritic diamondiferous deposits follow a north-south tectonic axis of around 100 km, stretching from around 40 km north of Lençóis-Palmeiras (Svisero *et al.*, 2017) to Mucugê further south, via Andaraí and Igatu. After erosion of these metaconglomerates *in situ*, the remobilised diamonds are trapped below by geomorphological traps within the mid-altitude parakarst (diaclases, caves), as at Igatu, for example, where so-called “lunchbox” diaclases form networks of anfractuosities perpendicular to the bedding of the metaconglomerate and trap diamonds, gems and black leached from upstream.

Figure 175 . Lapa Doce cave (*gruta*) in October 2015. Located to the north of Palmeiras, it shows a large parakarst network in the sandstone/quartzite beds with horizontal (centre) and vertical (stalactites on the right) water circulations. Photo: © Rafael Sgari, Wikimedia Commons (Creative Commons Attribution-Share Alike 4.0 International license).

In Igatu in particular, these large diamond-bearing karstic fissures were, in the memory of garimpeiros, extremely rich, as we have already commented. They were partly open-pit mined, although they were quite narrow (1-2 metres; Loureiro *et al.*, 2021). A carbonado weighing 205 g (1025 ct) was found here in 1940. A dozen kilometres to the north, examination of aerial maps of the area (-12.66 S, -41.39 W) shows that the Brejo da Lama – where Sergio's carbonado was found – is also part of a mountain plateau. It is also lined with

large diaclases (*frinchas*, “veins”) that appear to have been exploited, a speciality of *faiscadores* like Sérgio de Carvalho according to Ganem (2001). This karstic plateau is cut by a small valley (known as Canoão, Funch, 2005) which opens out further east at Bicas (-12.655 S, -41.373 W) and ends in the São José valley. Further down below these geomorphic traps at altitude, other clastic diamonds are found, but this time scattered among torrential boilers, embankments and, ultimately, geologically recent fluvial alluvium (placers).

5. The greatest mystery of diamonds

By combining mineralogy, geochemistry, geology and geology, we can begin to glimpse various models to explain the origin of these particular black diamondites. In simple terms, there is the terrestrial hypothesis (mantle with more or less fluid), the impact hypothesis and the extra-terrestrial model. The controversy remains lively despite the resources employed, which is stimulating the search for new key samples among the rare ones preserved, making it possible to decipher their origins, but also the development of innovative experimental techniques or increasingly complex "signature" reasoning on the part of researchers decoding their experimental data. Hence the importance of collecting these samples, but also of making them accessible to researchers. What would have become of the French Egyptologist Jean-François Champollion (1790-1832), hieroglyphs and Egyptology if the Rosetta Stone had been repolished or cloistered by a selfish collector?

The impact hypothesis. As far as the impact hypothesis is concerned, "black diamonds" have indeed been described in meteorites, such as the one at Canyon Diablo (Arizona, USA). But these are lonsdaleite, a hexagonal polymorph (more precisely, an allotrope) of native carbon (in other words, lonsdaleite is composed of carbon atoms like diamond, but their atomic arrangement is significantly different, resulting in very different physico-chemical properties). The "impact hypothesis" has therefore been strongly discounted ever since.

The mantelic terrestre. Some recent studies – including those mentioned above as well as Ishibashi *et al.* (2016), Piazolo *et al.* (2016), Shiryaev *et al.* (2019) and Ferreira (2020), among many others – seem to favour a terrestrial origin, linked to the formation of complex fluids supersaturated in carbon. Rondeau *et al* (2008) and Ferreira (2020) propose formation mechanisms in three or four stages, starting with mantle formation, followed by deformation, magmatic ascent and then a final stage with the crystallisation of hydrothermal phosphates (florencite, etc.). The Lebedinoe

diamonds/carbonados have also been interpreted as being of (sub)volcanic origin, as certain rare minerals, such as native aluminium and tin, are also known to occur in various local dolerite intrusions injected within gabbroite complexes (Shcheka *et al.*, 2006).

To complicate matters further, "carbonados-like" have recently been discovered in recent lavas from the Avacha volcano in Kamchatka (Kaminsky *et al.*, 2016) that are similarly "enriched" (at the level of concentrations remaining minor) in unusual heavy metals such as tungsten. These carbonados-like rocks thus form a new category of diamatites. They appear to have been formed by chemical vapour deposition (CVD) just after the eruption!

The extra-terrestrial theory. Haggerty (2017) rejects the terrestrial origin, arguing that these studies concern particular types of fibrous polycrystalline diamonds such as ballas (Pavlushin *et al.*, 2020) or bort (spherical or irregular in shape; Figure 1). The latter two varieties are significantly enriched in specific elements (uranium and thorium), as are other types of polycrystalline diamonds such as framesites and yakutites, which some researchers link to meteorite impacts, such as the Popigai impact in Siberia, a mega-impact dating back 35 million years and constituting the "largest diamond deposit in the world" (these are microdiamonds; Shiryaev *et al.*, 2018). However, the Dufrénoy composite specimen inv. 51.149 studied at the MNHN by Rondeau, Sautter and co-authors (Figure 164) shows all the mineralogical and geochemical characteristics of a Bahian carbonado at its base (these authors did not study the upper gem part as Haggerty (2017) implies. My XRF analyses of both parts of this specimen show no presence of uranium or thorium at its thresholds above 15 ppm (alone, the carbonado part being slightly richer in Al, P, Fe, K than the gem part in connection with clay and phosphate inclusions). Haggerty's (2017) discrimination therefore seems specious to me.

According to his research, carbonados contain osbornite (TiN, cubic), a mineral said to be emblematic of meteorites. However, osbornite is found in some rare ultrabasic rocks such as the Luobusha ophiolites in Tibet, certain kimberlite pipes in Ukraine and the Rakufet magmatic complex in Israel (and

their rarity does not make them an exception). His most convincing argument remains the presence of hydrogen in the carbonados and, more specifically, in its isotope composition. His various isotopic analyses indicate compositions that are unprecedented on Earth, of the interstellar type. According to this author, the carbonados were formed in a hydrogen-rich environment, perhaps outside the solar system, in connection with the explosion of a supernova or a destabilising planetary event. They would then have fallen to Earth 3.8 billion years ago, like “black diamond meteorites” in the Congo-São Francisco African-Brazilian craton. This craton then split as a result of the opening of the Atlantic Ocean following the fragmentation of Western Gondwana in the Mesozoic (250 million years ago), which explains the separation between the Brazilian and Central African deposits. The extra-terrestrial model is so spectacular and appealing that it is highly prized by journalists and auction houses. Much less by today's scientists.

6. The ultimate carbon evolution in life?

Figure 176 . Left: Shunga Island in Lake Onega, Russian Karelia (2010); right: sample of Russian shungite (2021; scale not given). Photographies: © Igor Georgievskiy and © James St. John (Wikimedia Commons, Creative Commons Attribution-Share Alike 4.0 International and Attribution 2.0 Generic licences).

The most recent studies on carbonados currently favour some terrestrial origin. In particular, the study by Afanasiev et al (2024) establishes a link between shungite and carbonado. Shungite is a group of dull to very bright black carbonaceous rocks thought to be derived from volcanic-petroliferous argillites that have been metamorphosed for 2 billion years at temperatures below 400°C. However, this substance cannot transform into graphite. It is

often polished into commercial cabochons (the trillon on the left on the third line of the Figure 146), especially the Russian material from around the Lake Onega (Figure 176) where most of the production comes from (shungite is also found in Finland, Canada, DR Congo, the USA, India, China, Kazakhstan, Austria, etc.). It is probably much more common than we think, as it can potentially be confused with graphite or any other type of bright coal (such as anthracite).

According to the Russian authors cited above, the Karelian specimens are around 2 billion years old and were probably more common during the Archean period. These rocks, bitumen-bearing saprolithes or some kind of Archean oil shales, were formed by the first forms of life, algae, are thought to have been metamorphosed in the depths of the Earth during the establishment of the Earth's plate tectonics 3.5 billion years ago. In particular, subduction zones buried large quantities of rocks formed on the surface, exposing them to increasing conditions of temperature and pressure. Under the effect of these parameters, Afanasiev et al (2024) propose that the carbon in terrestrial shungite was first buried, then recrystallised into carbonado, then eventually into diamond. Although more formal evidence is needed to support this hypothesis (which, alas, does not cite the major studies that could have supported this evolutionary model), the idea of a transformation of carbon from a nanodivised stage (shungite or other) to a carbonado stage (microcrystallized) and then to a diamond stage (macrocrystallized) remains interesting, whether the precursor is shungite or any other form of geological carbon, including biogenic, exposed to the conditions of the Earth's mantle where high temperatures and pressures prevail. The composite sample from the Muséum, a carbonado-diamond, in fact shows gem diamond nuclei emerging from a carbonado matrix. Again, it is a great pity that almost all of the composite specimens of this type, which have been abundantly found in the Chapada Diamantina since the 1840s, have all been crushed for the jewellery or mining industries.

Taking a step back, we realise, as de Sá C. Chaves and Gomes Brandão (2004), that some of these studies focus on decontextualised isotope analyses and do not really take geodynamic constraints into account. On the other

hand, It seems to me that each hypothesis is not mutually exclusive, as can be seen from the comparative analyses: in the same idea, olivine is found both in extra-terrestrial meteorites and in terrestrial rocks (basalts, skarns, etc.). Carbonados, in the broadest sense, could therefore be ubiquitous insofar as they correspond to physico-chemical formation mechanisms (yet to be specified) that can occur in many apparently antithetical environments (deep Earth versus space). Some authors are already using the term “carbonado-like” (pseudo-carbonado) to designate those formed on Earth by chemical vapour deposition (Kaminsky *et al.*, 2016). Advocating a single mode of formation, whether terrestrial (mantle or effusive) or extra-terrestrial, does not (perhaps) make too much sense. Moreover, researchers have claimed to have synthesised ultra-hard carbonados (polycrystalline diamond: Ekimov *et al.*, 2005) in the same way as Fremy, Verneuil and Moissan sought to do for ruby and gem diamonds in the 19th century. To do this, they reached enormous pressures and temperatures, of 8 to 9 gigapascals (around 80,000 to 90,000 times atmospheric pressure) and 2,300 to 2,500°C respectively. Finally, it should be noted that monocrystalline diamond can be formed both at high pressure and high temperature (HPHT) and by vapour phase deposition (CVD) at very low pressure. In both cases, diamond is still referred to as the end product. Could this mineral form rocks that are naturally more ubiquitous than previously thought?

An Eleventh Secret in the Form of a Legacy

1. The European decline of the 20th century

On the French side, the curse struck again. No fragment was ever recovered, however small, as the newspaper "*L'Anjou*" suggested in its day. However, this time the sum was relatively affordable: the equivalent of €3,600 today for each fragment of 3 to 6 carats. Once again, the Museum lacks the will to do so. This important carbonado is no longer there because of the limitless greed of certain industrialists: too bad for the incredible information it could have revealed about the formation of the Earth or even the Universe (we will come back to this). Its marine powder is found in the muddy shallows of the Thames, alongside that of the "late" Great Blue Diamond of Louis XIV, cut into an oval brilliant known as Hope (Farges *et al.*, 2008), and in the ballast of tunnels that are now disused.

A third curse befell this carbonado while it was still preserved intact in London. Its cast disappeared from people's minds: Alfred Lacroix did not mention it in any of the booklets in the Museum's collection (Lacroix, 1896, 1937). A fourth curse followed: less than ten years later, the *Cullinan* diamond was discovered in South Africa and the eyes of the world were riveted on this 3,106-carat (621.2 g) specimen of colourless transparency. The *Carbonado do Sérgio* was so confused with the Cullinan that its date of discovery was erroneously modified from 1895 to 1905 (Leonardo, 1937). Like its casts, the original was eventually forgotten. The ultimate pity: was its powder used to polish the Cullinans? Perhaps not. But other carbonados were forced to do so, inevitably Brazilians, because that country, between the states of Bahia and Minas-Gerais, had a virtual monopoly on production at the time (Borneo produced very little of these minerals; Herold, 2013; deposits in the Central African Republic were still unknown before 1924).

As for diamond merchants, especially European ones, they had to gradually abandon the use of carbonado, which had become too expensive due to the intense tunnelling, mining and drilling activity in the United States. The Americans quickly redirected the Bahia industry towards conquering their

western lands and their rich deposits via the railways, which were booming at the time, especially as the after-effects of the "Monroe Doctrine" (1824) intensified, seeking to favour trade, including with Brazil, in favour of the United States of America to the detriment of the Europeans.

2. The oblivion

Pereira (1895) believed that the discovery of Bahia's diamond wealth, in addition to its renowned coffee production, would inevitably bring the railways and telegraph, the form of prosperity then enjoyed at the Lavras Diamantina, where no one would lack anything ("*Quando tivermos estradas de ferro e telegrapho nada nos faltará*"). The telegraph arrived with difficulty, electricity took too long and access to the Chapada Diamantina by transport remained a long and patient affair.

Figure 177 . The Bahian "*Rei do Carbonato*" (King of Carbonado) in 1919, according to Bahia Illustrada (No. 6, May 1918, p. 22). The illustrated "Dr Barreto de Aragão" is possibly Antonio Muniz, brother of Dr João Muniz. This family produced great Brazilian doctors. At this time, the Europeans left the Bahian carbonado trade, which became the monopoly of New York importers who heavily influenced Brazilian politicians. The graphics of the carbonados are a delight compared to this pompous portrait.

From 1910 onwards, leading figures in the Brazilian medical world, who were not without lucrative entrepreneurial vision, and New York tycoons, who were just as devoid of patrimonial vision, enthroned themselves respectively as *Rei do Carbonato* (Figure 177) or *Carbon Kings* (Herold, 2013, p. 21 : about

Simon Dessau, New York importer of carbonados). This new Brazilian-American "aristocracy" of tycoons is confiscating the carbonado market from the Europeans.

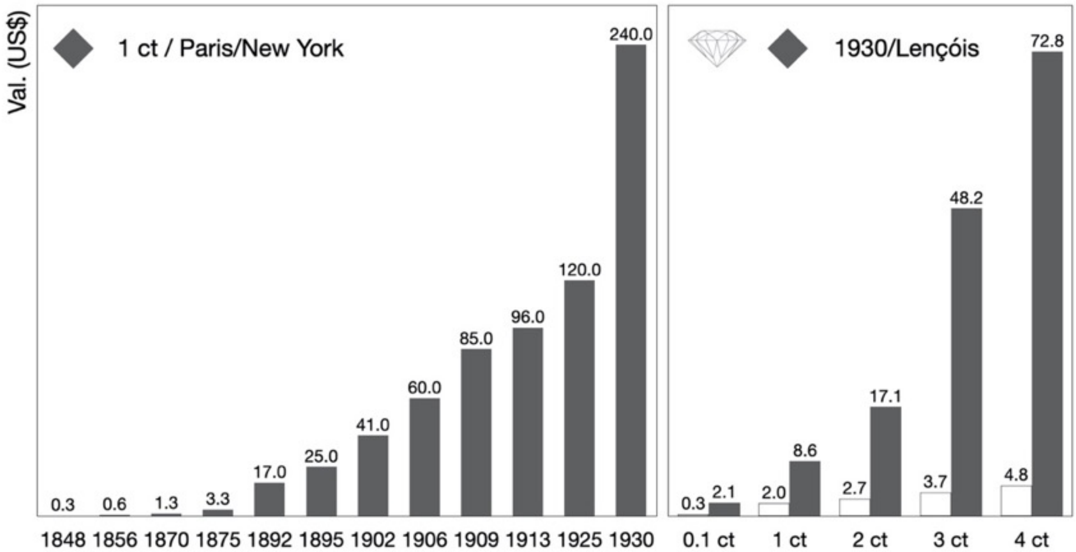


Figure 178 . Carbon price trends: left, smoothed values between 1848 and 1930 at the final selling price per carat on the Paris/New York markets, homogenised in US$ (source: Herold, 2013); the two price jumps, around 1875 and 1925, are due, respectively, to the introduction of the Leschot system and the massive development of oil drilling; right, comparative change in the price of gem diamonds and black diamonds paid to miners in Lençóis in 1930 (average value on 27 August; Meira da Andrade, 1999). Note, for the one-carat category, the difference in price between gem diamonds (on average two-thirds of Bahia's production) and black diamonds (the remaining third). Note how the difference between the price paid to miners and the price paid by the final industrialists (the exporters' margin) increased tenfold, from x2 in 1902 to x28 in 1930, with the rise of the oil companies after the First World War, which supplanted the tunnelling and mining industries. Shortly after 1930, the prices fell dramatically as a result of the 1929 depression and the discovery of carbonado substitutes (use of bort, special steels etc.).

According to Herold (2013, p. 21), Simon Dessau and Co. had even secured a contract with the Brazilian government in the late 1870s that covered the entire output of Bahia's largest carbonado mines. Not all mines, obviously, since a significant percentage of the production of the smallest mines was exported to Europe, ranging from 40% to 80% depending on the year (Herold, 2013, p. 19), depending on the often-uncertain productivity of the deposits.

The price of carbonado (Figure 178) then far exceeded that of the best quality gem diamonds, fuelled by the greed of US oil drillers, who who are in turn supplanting the mining and tunnelling industries in their need for drill bits set with black industrial diamonds. But not for long, because geology (still)

controlled these industries: the ratio of diamonds to carbonado extracted (by mass) varied around 1/3 (Furniss, 1906) and then, thirty years later, reversed to 9/1, even though it could be as high as 5/5 locally (Leonardos, 1937). The industry was being inexorably depleted, despite a few discoveries in the 1940s. At the same time, this strategic and expensive resource was confiscated by the US magnates from their Europeans competitors, who were more concerned with World War I, which led to their economic decline. European diamond merchants switched to the bort to polish the gems, which was abundantly produced in South Africa.

Figure 179 . Set of "black diamonds" collected in Brazil in 1976. Photo: © Edouard Gübelin (ETH-Zürich, https://ba.e-pics.ethz.ch).

Nevertheless, the memory of this imposing carbonado resurfaced in the 1960s at the Gemmological Institute of America (GIA), in connection with the American habit of naming large gems (Copeland, 1960). From then on, it was nicknamed "*Sergio*", which should have been *Sérgio* in good Portuguese. Reis (1959) also states that he is also called "Lavrita" (in Brazil, "laverita" is a generic synonym for carbonado, as are "lavrite", "carbito" and "carbon bort"). What is more, the GIA does not use the name "carbonado" in its gemological certification reports, but "black diamond", which is "*so chic*". It continues to be

harvested as a by-product of gem diamond mines (Figure 179).

More recently, the memory of Sergio has been revived in Brazil: a street has been named "rua Carbonato de Sérgio" in Lençóis. Another was named "rua Sérgio de Carvalho" in Salvador. However, obvious errors persist: following Leonardos (1937) and others, Sergio is still too often incorrectly announced by historians and gemologists (Herold, 2013, Svisero *et al.*, 2017, Shigley, 2020) as having been discovered in 1905 when it was already destroyed at that time. Let me repeat that, ironically, this date coincides with that of the discovery of the Cullinan in South Africa!

3. What remains of this grandiose epic?

Truly industrial exploitation of the carbonados did not really get underway until the 1910s, when American investors signed an exclusive agreement with the Brazilian government, bypassing the Europeans. In the meantime, the multitude of micro-exploits had eroded the soil: the São José valley is a field of dust from deforested mountains. Mining collapsed with the 1929 crisis and the development of ultra-hard steel drill bits or, for diamond manufacturers, bort grinding wheels, which are more abundant than carbonado.

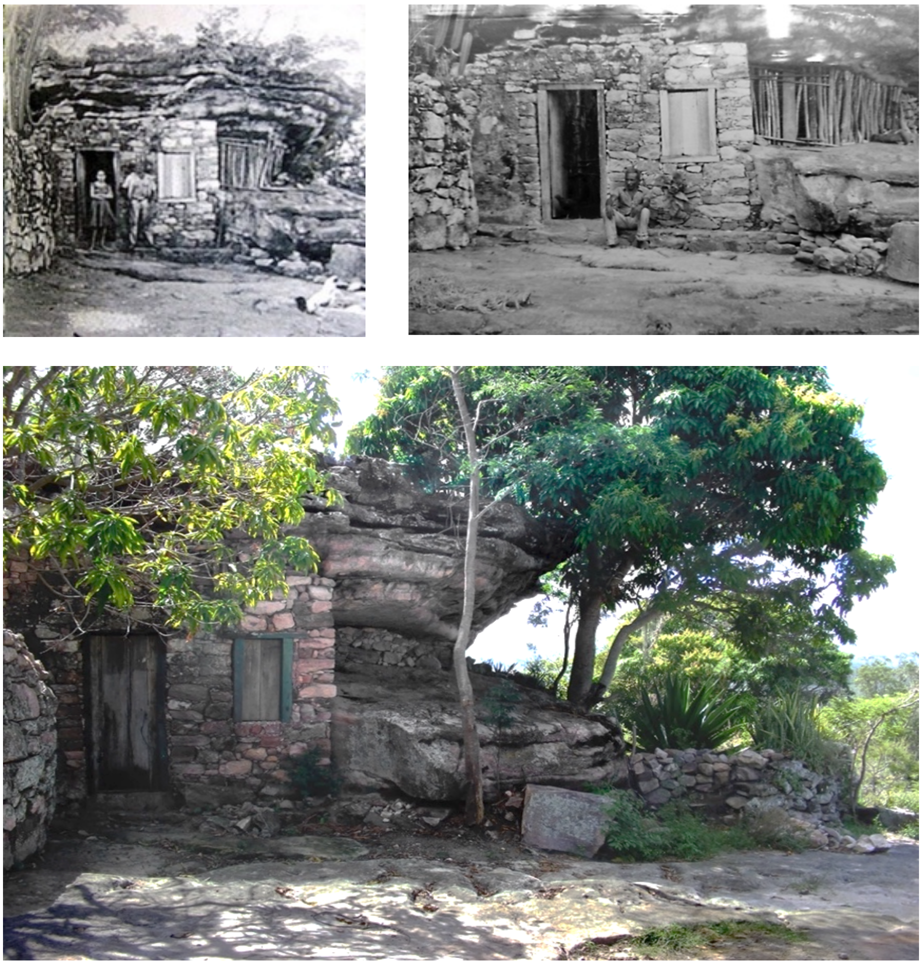


Figure 180 . The "*toca de Joaquim, garimpeiro d'Igatu*" (toca opf Jaoquim, garimpeiro from Igatu), a site that has become a tourist attraction. Photos: © unknown (all rights reserved), © Roy R. Funch (based on a 1984 photograph from the collection of garimpeiro Mestre Oswaldo, with permission, and © Mizael Bispo (2013), Wikimedia Commons (Creative Commons Attribution-Share Alike 4.0 International license).

The parakarsts Ironically, the over-priced carbonado was a victim of its own success: its use disappeared for good after the Second World War. And it was not the only one: many other large specimens found in this region all disappeared afterwards, including two of 2240 and 997 carats (Pereira, 1895) and a good twenty of around 650-800 carats. This includes a 740-carat carbonado found in the same area as Sergio in 1944 (Meira de Andrade, 1999), not to mention others that were not declared, such as the 328.8-carat carbonado from the MNHN. And yet, without carbonado, mine galleries, boreholes and other shafts, canals, underground railways and other tunnels could still have been dug using bort, the so-called industrial diamond, or even a synthetic abrasive such as moissanite, or carborundum, as the industry was forced to do after the 1930s. In the meantime, we have preferred to waste the most precious of *bambúrrios*, where stars, humanities and diamonds form a virtuous trio. Existential knowledge, truths buried deep beneath a vile shell of appearance.

With the mines in decline, the fazendeiros dismantle their properties and leave. The *tocas* of the garimpeiros – so emblematic of these landscapes (Figure 180) – are gradually being abandoned. From tens of thousands of inhabitants in the 1910s, Lençóis had only a thousand left by 1970. Ruined walls, abandoned *tocas* and emptied graves are adorned with scrub (Figure 181) "where oblivion reigns" (Ganem, 2001).

of the mountains between Lençóis and Mucugê have been emptied of their diamonds and also of their *cascalhos*, whose clayey nature no longer plays its role as a natural water reservoir, regulating the flow of the rivers below: xerophytic vegetation of the *caatinga* type is developing to the detriment of rainforests, as the watercourses dwindle during semi-arid periods such as 1877-1879 or 1930-1955, when famine and exodus were devastating (Loureiro *et al.*, 2021). This increasing aridity has fuelled forest fires, which have become the greatest danger (Funch, 2004). Down below, mining gravels resulting from the systematic stripping of *cascalhos* in the mountains invaded the alluvial plains, covering them with vast sandy areas made up of gravels from mining tailings known as *mocororô*. During this period, mining continued sporadically, as at Igatu (Figure 182) or Salobro (Figure 183), where diamonds and carbonados

are still recovered, either legally or illegally (Martins, 2003).

Figure 181 . The ruins of the mining village of (Xique-Xique do) Igatu, the "Machu Picchu of Bahia" to the south of Andaraí. The houses were covered with thatch from the *pindoba* palm (*Butia capitata*). Below, the Pantanal Marimbus, from which flows the Paraguaçu, a diamond-bearing river meandering through alluvial deposits, many of which are the result of dismantling mines upstream. Photo: © Paiivaleiite, 2009 (Wikimedia Commons license, Creative Commons Attribution-Share Alike 4.0 International).

Extraction was frantically revived in the 1970s thanks to the industrialisation of the methods used. It polluted water as never before. At the same time, employment remained scarce for those who refused to move to the favelas. Tourism and "historical and cultural" heritage are becoming extremely intertwined issues in the Chapada Diamantina, with a stated aim of economic and "sustainable" recovery through various processes of cultural and natural heritage.

A number of US *Peace Corps* volunteers, including Steve Horman and his *Movimento de Criatividade Comunitária* (Social Creativity/Reinvention Movement), as well as various local communities, contributed to the Brazilian authorities classifying the historic centre of Lençóis as a "Patrimônio Cultural Nacional" (National Cultural Monument) by the *Instituto do Patrimônio Histórico e Artístico Nacional* (IPHAN) in 1973 (Duggan, 2001; Mangili, 2023). Its historic centre

currently boasts more than 570 one- and two-storey buildings dating from the second half of the 19th century. That of the fleeting diamond rush.

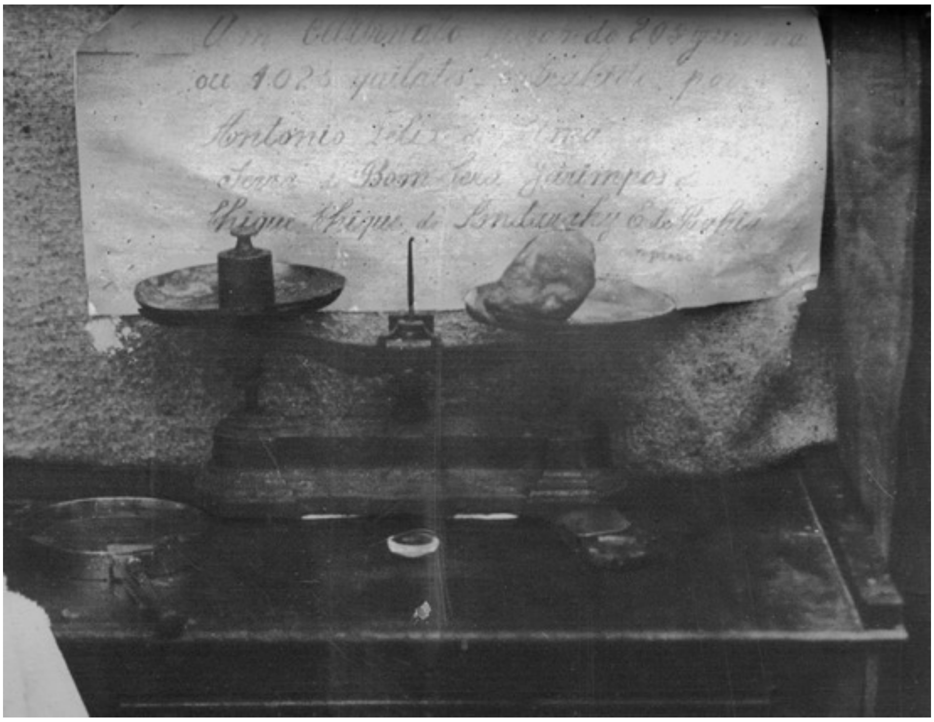


Figure 182 . The last discovery of a large carbonado weighing 205g (1025 carats) is immortalised in the historic 1941 photograph of its seller weighing it. The inscription in the background states that the black diamond was found by the garimpeiro Antônio Félix (da Silva) at the garimpo de Serra de Bom Será in Xique-Xique de Igatu and, in very small print, that payment was made in instalments. This find does not appear to be mentioned in the literature, the closest being the "Bom Será", a 931.60-carat specimen discovered in the João E. Socorro mine in the same Serra de Bom Será in early 1939 (Meira de Andrade, 1999). Photo and transcription: © Marcos Zacariades/Galeria Arte & Memória with permission.

Large-scale mechanised mining – these dredgers extracted thousands of diamonds from the riverbeds of Lençóis until 1996 – was banned that same year, to the great relief not only of the various nature protection movements and other environmental agencies but also of the "mountain" garimpeiros, creating a strong cultural link between these two entities. The latter claim to be "traditional" according to the definition given by Diegues (2001). The authorities also realise that biodiversity is regenerating too slowly.

In fact, a sort of cultural heritage had already begun in 1922, with Afrânio Peixoto's novel *Bugrinha*, for example, which is one of the works that depicts a Lençóis at the end of the 19th century and the beginning of the 20th century, when black diamonds were systematically exploited in a still

traditional way. The novel went on to inspire the 1977 film *Diamante Bruto*, by filmmaker and journalist Orlando Senna. Born in Lençóis like the writer Afrânio Peixoto, Guanaes (2001) explains that Senna describes his city as (translated) "locked up, separated from the rest of the world, in a time of both splendour and decadence. At the height of its wealth, it refused to obey Rio de Janeiro and Salvador. A legacy had just sown its seeds, and these patient fruits would begin to unfold half a century later."

Figure 183 . Four octahedrons (maximum 6 mm long, together 8.6 carats) of gem diamonds (colourless above, brownish-yellow below) probably mined during the first half of the 20th century at Salobro (Bahia, Brazil), gift of Colonel L. Vésignié, 1955. Paris, MNHN, mineralogy, inv. 195.183. Photo: © François Farges/MNHN.

4. Roy I

All of this environmental devastation led the State to create Chapada Diamantina National Park in 1985, on the initiative of various personalities including other *Peace Corps* volunteers such as Roy Funch and David Blackburn, and local representatives such as Humberto Brandão de Sousa (Duggan, 2016). It was envisaged that a nature park, like the Lençóis inscription, could attract tourists and help rebuild the local economy, which had been devastated by the end of mining. Funch's proposal (1982) is in line with the North American concept of Yellowstone National Park, the second largest protected natural area in the world (1872), after the "nature sanctuaries" in the Fontainebleau Forest (1853, 1861; Luglia, 2021). Despite certain differences in approach between France and the United States of America on these issues, these two protected natural areas have the same original dual objective: to provide recreational areas – breathing space in the USA or inspiration in France, note the difference – while protecting them from the excessive exploitation of their natural resources. In fact, Funch's Chapada Diamantina project is at times (and purely coincidentally) closer to the French sanctuaries inspired by the painters of the pre-impressionist Barbizon school and the premonitory "pro-nature" writings of Victor Hugo and, above all, George Sand. Funch also thought of protecting the natural beauty of this region without excluding its humanity. This is the landscape modified by humanity, including the garimpeiros, who had already been "written about" by great local writers such as Afrânio Peixoto, Herberto Sales and Walfrido Moraes.

The contributions made by miners as key players in this environment are showcased in spectacular events such as the *Senhor dos Passos* procession in Lençóis, which takes place every year between January and February. Here, miners parade in traditional and ceremonial dress with strong, colourful local symbolism, including the jarê, and even in full brotherhood uniforms, as in Germany and Italy (in contrast to many mining parades in France, where the preference is for austere work clothes, like Émile Zola's Germinal). Academic studies of all kinds (geology, history, sociology, environment, linguistics, etc.),

maps, censuses of garimpos and other socio-economic relics, accessible books – not to mention the internet – immortalise in the collective memory the successive waves of natural and societal events that shaped these present-day landscapes, at the heart of which diamonds – gem or black – are one of the keystones.

Figure 184 . Various crystals collected in the 21st century from a clandestine placer in the Chapada Diamantina. Recent diamond discoveries in Brazil, particularly in primary kimberlite deposits (for example, the Braunà mine in Nordestina), are restoring the country's status as a major world producer in the 18th and 19th centuries. Photo: © Pedro Brito Candido Ferreira (2014), Wikimedia Commons (Creative Commons Attribution-Share Alike 4.0 International).

At the same time, heritage restoration programmes such as the Historic Towns programme (1979) or Monumenta (2002-2011) have repeatedly invested resources in a few emblematic buildings in Lençóis, such as the so-called former French vice-consulate, while leaving aside other projects that are more representative of the miners' social group, such as the Casa de Lapidação, the Rancho do garimpeiros (2008) or the Museu do garimpeiros (Mangili, 2023), which was nevertheless renovated in 2023. As a result, the Chapada

Diamantina has been marketed more as an ecotourism product (Mangili, 2023), ignoring the world of the garimpeiros, to promote a more attractive tourist destination based on the dream of a natural environment that city dwellers see as pristine, picturesque and recreational: relief, waterfalls, natural pools, flora and fauna where, on the ancient paths of the bandeirantes, trekkers, picnickers and campers sometimes leave traces of their passage (Guanaes, 2001). At the same time, the ecological association SOS Chapada Diamantina is trying, in particular, to prevent the fires that are ravaging the serra.

5. Eco-tourism and the forgotten mines

The extraction of diamonds (gems) became artisanal again and was sometimes tolerated within the national park (Figure 184). In the 2000s, 24 garimpeiros were still mining the Bicas placer (Meira de Andrade, 1999), located in the park but in the lower reaches of the river. In the mountains, the few garimpeiros still used rustic hand tools to break up the gravel. Their objective was not the preservation of the natural environment as such, but the impossibility of conducting mountain mining in any other way, determined by nature itself (Guanaes, 2001). While ecological concerns were focused entirely on mechanised mining in the valleys, tourists were devouring mountain nature. The serra around the Brejo da Lama is rarely visited by a handful of hikers for its "wild" landscapes: the intensive anthropisation of mining is increasingly concealed in favour of the bushy *caatinga*, refreshing waterfalls and other "natural pools" that once held diamonds.

Among the disused *tocas*, a renovated guèbe now houses the Vivo do Garimpo museum in Mucugê, dedicated to the garimpeiros of gem diamonds: the black diamond is eclipsed by facsimiles of South African brilliants. The last garimpeiros, recycled as guides, explain to city eco-tourists who, between two dives into giant pots, visit the old concessions in 4x4s from their sometimes particularly refined luxury hotels, swapping the diamonds of their forebears for the latest smartphone. If Lençóis was once a showcase for the art of living fantasised about in Paris (fashion, Pleyel pianos, champagne, etc.), Igatu has become the "Machu Picchu of Bahia". This transition ushers in a more South American identity, even if it still conforms to clichés, since Igatu and Machu Picchu have not so much in common other than being built of stone. Moreover, the inflation generated by tourism is still negatively perceived by the miners, while the local economy has not generated half the jobs promised (Guanaes, 2001).

In the midst of these now listed and moving ruins, artist-entrepreneurs including Marcos Zacariades, a city dweller who emigrated from Salvador, are promoting sustainable cultural development that benefits not only visitors but above all the locals. Its art museum, the *Galeria Arte & Memória*, both open-air

and under cover, is a must-visit haven for breathing, distancing and emotions, presenting impressive pieces of contemporary art alongside historical objects adorned with touching symbolisms (Figure 185). Here, a used *carumbé* and a slave restraint weight tarnished by history. And there, silver photographs from another bygone era, drenched in blood and sweat (Figure 182) shows the weight of a 1025-carat carbonado once found here: the date is 1939, but it looks as if it came from a distant 19th century. As you make your way through the open-air exhibition, you'll find a display case featuring a number of antique objects, including four small carbonados accompanied by a *picuà*. As was the case in Paris during the *Pierres précieuses* (Gems) exhibition, some visitors notice these precious witnesses, whereas the museum's other displays, mainly of contemporary art, are given more prominence on internet blogs and other tourist websites because they are actually more immediate to understand. However, the subtle museology of the site will help volunteers to realise the profound links between these materials.

Figure 185 . The Galeria Arte & Memória open-air museum displays a cross that was once placed on top of a nearby hill, the Morro do Cruzeiro de Baixo, in gratitude for the discovery of a large carbonado weighing 205g (1025 carats; details in Figure 182). Photo: © Marcos Zacariades/Galeria Arte & Memória with permission.

All of these initiatives contribute to a perspective of cultural and historical heritage of nature and local societies (Mangili, 2023) following the example of our eco-museums, “mine museums” and various events around the mine, which have become a historical argument despite certain elements that have a negative connotation with the general public, in particular everything that encompasses the existence of a mine. The original “demand for fraternal humanity” – once imposed by any excavation that makes every miner in the world weep when it closes – is revised into a “romantic retrospective” of a time that some say is “happily over” but which tends to forget what *bambúrrio* and other *pedra de raio* mean.

6. Roy II

By dint of travelling virtually via the Internet in these lands so far from France, I contacted various well-known local academics, but only one got back to me: Roy Richard Funch. I took him for a good Chapada backpacker, a descendant of a local *fazendeiro* or *bandeirante*; in short, a pure native. If he did not have a Lençóis accent, I did not recognise any foreign intonations in his Anglo-American speech, apart from an unusually chromatic je-ne-sais-quoi. In fact, we wrote earlier that this academic emigrated from his native Arizona to Brazil on a *Peace* Corps humanitarian mission almost fifty years ago. This botanist and ecologist fell into the trap of *saudade*, gave up on the so-called *American Dream*, put down roots and started a family in this corner of Brazil that is still quite remote from everything, but where a vital depth still reigns, untouched by the toxic hassles of the city. In truth, this atypical man (you don't mind me saying it like this, do you?), this veritable *Indiana Jones* off-camera (still not?), has criss-crossed the Chapada Diamantina for decades in search of an arch in perdition: the last garimpeiros and the remnants of the region's history, those other veritable forgotten diamonds of heritage. He patiently explains what I don't understand, which I have reproduced here. Above all, I understand that ,despite economically extinct mining, with very little extraction and no profit, the garimpeiro continue to occupy a special place in the cultural configuration of the Chapada Diamantina: they know the area, they are its best guides, and they provide the basis for scientific expertise in naturalism, as well as decisions about the future of the national park.

7. More Bahian splendours

Figure 186 . Sphere (⌀ 2.2 cm) of rutilated quartz from Novo Horizonte. Private collection (with permission).

These superb mountains, unknown to the general public, have also been renowned by mineralogists since the 1970s for their rich geology. In the east, in particular, there are veins of rutile quartz (or “Venus hair”), which are still actively mined in Novo Horizonte for jewellery (Figure 186). Much further south in Bahia, the sodalites of the Hiassu fazenda and, to the north this time, the emeralds of the Carnaïba district, around Pindobaçu, have seen a new rush since the 1960s. Here, very large emeralds have been found, which were cut or sculpted (Figure 187), the largest of which in August 1974, according to the Guinness Book of Records, weighed 86,136 carats and was carved by Richard Chan in Hong Kong. These are the world's largest emerald deposits, which are already running out of steam. Once again.

Figure 187 . Perfume bottle carved and engraved in the neo-Indo-Mogol style from a single-crystal emerald from Carnaïba (Bahia, Brazil), weighing 556 carats. 45 x 55 millimetres, donated by Paul-Louis Weiller, 1977. Paris, MNHN, mineralogy, inv. 177.19. Photograph: © François Farges/MNHN.

This gemmological diversification no longer conceals the boom in mineral collections, which reflects a sort of return to nature that is currently prevalent in the minds of city dwellers. And Bahia, like its better-known southern cousin Minas Gerais, is not to be outdone. The Brumado mine, for example, produces the jewel in Bahia's crystallization crown, with its world-class specimens of dolomite (Figure 188), metazeunérite, sellaite, hydronováčekite and isokite (Cassedanne and Cassedanne, 1978; Barbosa *et al.*, 2000) previously crushed in a crusher. Aesthetic mineralogy was even developed and triumphed among wealthy collectors, with crystallisations some of which were even "improved" compared to what nature produced. Here, an annoying gangue is eliminated, and there, crystals that detract from the overall aesthetic are removed, according to the fashion of the moment. Some "repairs"

are so outrageous to a naturalist that they become "more beautiful than nature". This "augmented nature", often stereotyped, is presented by certain New York gallery owners and Parisian auction houses as "Mineral Art". It is currently invading the "top of the range" (which I now call *porn-mineralophilia*) which, here too, highlights a dichotomy between nature as experienced by the garimpeiros and the fantasised nature of city dwellers.

Figure 188 . On the left, rock crystal on dolomite and, on the right, sellaite with rock crystal. Brumado (Bahia, Brazil). 5 x 7 and 4.4 x 2.5 cm. Saint-Malo, Minerallium Roullier and Paris, Muséum national d'histoire naturelle, minéralogie, inv. 190.123. Photos: © François Farges/MNHN and Louis-Dominique Bayle/MNHN.

In contrast to these recent trends, for which the quest for aestheticism remains the primary vocation, Sergio is the symbol of a "broken face" in

mineralogy, perhaps a still mysterious mantle aggregate, or perhaps a diamond meteorite, undoubtedly multi-billion years old ,of little interest to collectors-investors, but to rare enthusiasts of stories and adventures both geological and human. It links a forgotten Brazilian miner, a spark of a day, to a French Nobel Prize winner in chemistry whose rich intuitions are soon ruined by the steamroller of industrial tycoons.

8. A glory rediscovered

Thanks to the L'École of Jewelry Arts in Hong Kong, supported by the Maison Van Cleef & Arpels, my “Black Diamonds” exhibition was able to show the public the various pieces that went to make up this work (Figure 189) thanks also to the vision of its director, Olivier Segura, who has long been aware of the importance of historic and authentic black diamonds, which were finally reappearing after a century of enforced discretion imposed in such insidious ways. In cooperation with the Muséum national (français) d'histoire naturelle, the Parisian cast of the Sergio was exhibited there in November 2024 along with various other pieces from the Muséum national d'histoire naturelle in Paris previously illustrated here, such as the large Bahian black diamond dating from 1848 and weighing 328.8 carats, the historic replica of the Cullinan (1905) and the front of the bodice enriched with the large Central African black diamond weighing 119.77 carats from the Horovitz collection in Geneva. As well as science and art, I wanted to bring in the human and historical touch of the Brazilian miners, without whose strength and knowledge all this would have been in vain: the tools of the garimpeiros and the *picuà* à carbonado were also presented.

This L'École-MNHN co-production was staged around black and white, in a ying-yang spirit, which made it possible to work on the contrast between colourless and black diamonds. Duo lectures, known as “conversations”, enabled visitors to discover the many aspects of black diamonds, from scientific reality to jewellery beauty, human perseverance and the “black legends” that no longer have any reason to affect the reputation of these extraordinary geological substances. The audience, mainly from Hong Kong, was delighted to discover a little-known aspect of diamonds that is often overlooked in the major anthologies on diamonds in jewellery, as well as the diversity of their industrial uses, which were so important during the second industrial revolution. This aspect was particularly emphasised by the audience, for whom the ‘industrial arts’ constitute one of the essential foundations of their culture (an aspect that has regressed considerably in France for many years now).

Figure 189 . A view of the “Black Diamonds” exhibition in November 2024 at the Hong Kong School of Jewelry Arts in cooperation with the Muséum national (français) d'histoire naturelle. The display case showing various pieces discussed in this book in a scenography that combines history, science and art in a ying-yang aesthetic that also highlights the heritage of the garimpeiros of Bahia. From left to right: the historic replica of the Cullinan diamond on its base (1905), the large 328.8-carat Bahian black diamond (1848), the large 119.77-carat black diamond bodice front, the picuà with carbonados and the replica of the Sergio (1895). Behind the jewellery display stand the garimpeiros' tools, including the three *carumbés*, one of which is partially visible. Photo credit: François Farges.

9. A return for a thank you

The Sergio story shows just how much nature seems to be “just right” for speeches and (re-)elections, but less so when it comes to taking action, in Brazil as in France and elsewhere. This rediscovery demonstrates, once again in my view, the chronic curiosity of decision-makers to the detriment of knowledge and nature. When it comes to preserving a unique natural heritage, all for the sake of vain savings, as this story of *faiscadore* perfectly demonstrates, one among many others. On the basis of the quantities declared to Brazilian customs, we can estimate that well under 0.01% of the black diamonds mined in Brazil have been preserved in various collections: is this representative? Have we preserved any of their “Mona Lisa”? How can we identify these masterpieces of nature on the basis of such a small residual corpus?

Let's hope, though, that the travellers who have been enchanted will have had a good time crossing the tunnels of Mont-Cenis, the Saint-Gothard, the London Underground or navigating through the Suez or Panama canals, where these incredible marvels of nature were immolated. As a consolation prize beyond the Museum's moulding, a street in Lençóis bears his name, the *rua Carbonato de Sérgio*, while in Salvador, the capital of Bahia, the *Rua Sérgio de Carvalho* omits *Borges*. Finally, let's not forget that many of the crystals in our mineral collections, acquired from the second half of the 19th century until the 1940s, as well as the first trains, aeroplanes, cars, skyscrapers and underground railways, owe a great deal to the sacrifice of Sergio and his acolytes, who have now been lost and forgotten, even though they promised to be fabulous encyclopaedias.

As for the last of the diamond garimpeiros, they deserve to be listened to – their flame will live on forever. Their rich mining past has fuelled this history, adorned with precious architectural testimonies, oral histories and local music. Its reputation, its human history and its magical Brazilian name ,*O carbonato de Sérgio*, with its intonations that instantly drew me in, laid the foundations for the human saga that continues that of the geology of an anonymous carbonado. For, as far as nature is concerned, all stones are the same, mute and silent, waiting in their own darkness until erosion gives them the light of

the sun, the time of respite, before being buried again by an earthquake, an avalanche or a torrential downpour. Sergio's ultimate secret, like that of any diamond, lies in this intangible heritage that he has bequeathed to us, unwittingly and at his own expense.

Figure 190 . Moissan's historical cast, deposited at the Muséum national d'histoire naturelle in 1896, and its replica (June 2024) in glossy black polylactic acid before its one-way journey to the *Memorial do garimpeiros* museum of the *Sociedade União dos Mineiros* (SUM) in Lençóis for donation. Its comparison with the historical photograph of the original found at the MNHN – Figure 158 – is strikingly realistic. Photos: © François Farges (/MNHN for the historical cast on the left).

Sergio is a little bit missing from this Chapada Diamantina, from its garimpeiros and their dialects, from its history, from its politics, as I tried to illustrate earlier. All we know of this mythical *Sérgio carbonate*, which is still the talk of the town, even though it has been forgotten elsewhere, are these vague and unfair black and white snapshots from the beginning of the century in a setting that is already worn out and tired of living. And how can we forget our debt? I meant the debt of our forebears who tried to preserve Sergio, in vain.

So I did what I had to do: from Paris, I had a faithful polymer copy of Sergio's replica made. Next to the original Moissan cast, which I now see as rather dull, if not quite sad; the copy seems animated by a luminous,

satiny black breath, if not exaggeratedly gaudy (Figure 190). The first must have tarnished over time, because this type of alloy is not that stable in the presence of oxygen. The second now steals all the light. The glossy black of this piece of plastic, which I thought was almost too much, can be seen in this photograph from 1913, which I found again much later.

Figure 191. The replica of the *carbonado de Sergio* (and its donation label) arrived in his homeland, welcomed by his family, at the *Sociedade União dos Mineiros* de Lençóis in January 2024. Photo credit: SUM.

The replica is destined, via Roy, for the *Memorial do garimpeiros* created by the *Sociedade União dos Mineiros* (SUM), a cultural association founded in 1927. The donation arrived there in January 2025 (Figure 191), but the Brazilian customs authorities had their work cut out for them (the first shipment was refused in São Paulo and then 'lost' by the French Post Office in Talence on its way back).

I'm fully aware that this piece of plastic is only a replica, despite all the care taken with it. Duly noted. The essential thing is elsewhere. As a human being, and despite this transfer of clarity opportunely validated *a posteriori*, I don't see any esoteric message in it, other than this message or - who knows -

a *bambúrrio*. But as a scientist, I don't see any superfluous prophecy in it, other than a wish that joins the other contributions seeking to show our simple gratitude towards a heritage that has remained too little known or even ostracised. I relish the outrageous insolence of this piece of plastic, which is the unsuspected but legitimate fruit of the present work that gives it some of its honor. A clone of Beauty and the Beast, but two-in-one, as the moral of the whole story.

EPILOGUE

A number of writers and journalists, first French-speaking (Dutens, 1777), but especially English-speaking (see Balfour, 2008 and the many blogs on "superstar diamonds", most of which plagiarise each other), have quickly taken to inventing or propagating black legends. They involve mythical thieves, mostly profane and venal Frenchmen, soldiers and priests, immoral and smelly cheese-eaters, in an India they plundered a bit less than the British. Their supposed booty, all those famous diamonds that now adorn the most splendid treasuries in the lands of English language, were never cursed, nor did they need to be: the Orlov, the Hope, the Koh-i-Noor and the Black Orlov, among many others, already had dramatic stories by nature.

But Sergio remains, in a sense, cursed, largely ignored and even ostracised to this day. While his blackness, his obscure geological origins, his epistemological complexity and his unique influence on Bahian society, like no other, have enriched Him: beyond injustice, a natural and pure philosophical reason teaches us this theorem in eleven paragraphs.

A mirror of our histories, whether splendid or toxic, Sergio has offered us, through this medium, the greatest secret that the most imposing diamond known on Earth can conceal: a rich geological and human epic that is still being written. During his symbolic return to his homeland, I stumbled over my handwriting because I wanted to add the word "natal". Of course, this carbonado was not born in Lençóis, or even in Vila dos Lençóes: He was formed long before the Chapada Diamantina, when geodynamic phenomena shifted it from one place to another, and a fissure filled with clay, quartz gravel, tourmaline, jasper, blocks of conglomerate, gold nuggets and other diamonds, gem or black, all anonymous and in fairness, devoted only to themselves.

Like a provocative Oscar Wilde, who said that nature is inspired by art because the concept of nature is a human creation, I am convinced, as a standard city dweller that I have become with my age, that the power of the *jarê* will give this simple block of black resin its most beautiful finery of adamantine energy that I haven't been able to give it since Paris, a city which,

in its time, was the first to celebrate Sergio with dignity, even if, *in the end,* it failed in its universalist task, which, however, it continues to guarantee to the world, sometimes too arrogantly and with too few concrete results compared to its promises.

For the memory of Sergio's diamond and those over there who have not forgotten him, a fair, simple and necessary return of our tribute. Literally and figuratively.

“You're welcome”, as Adriano Peixoto suggested in the quote that introduced this book. And which concludes it.

Figure 192. The spirit of the *Carbonato de Sérgio* at home, by the *Sociedade União dos Mineiros* (SUM) in Lençóis (February 2025). Picture : SUM/Roy R. Funch.

GLOSSARY

alavanca: miner's lever (a kind of crowbar).
alferes: ensign-bearer, officer in charge of carrying the flag.
alluvium: sedimentary deposit consisting of clastic rocks deposited by rivers in a valley or plain or on a beach or delta.
almocafre: miner's hoe.
bacias: basin.
Bagagem: town and river in Minas Gerais renamed Estrela do Sul following the discovery of the South Star diamond in 1853.
balas (or Ballas): a microcrystallized diamond forming a ball-like spherule.
bambúrrio: a success in the game; for the garimpeiros, a large diamond or a set of beautiful gems.
bateia: pan to sort small gravel. Thanks to a circular movement and in the presence of a little water, the densest minerals, such as gold or diamond, are concentrated in its center.
belemnite (rostrum of): internal skeleton, in the shape of a rifle cartridge, often fossilized, of cephalopods that lived from the Devonian to the Cretaceous. It could be considered in Portugal and Brazil as a variety of *pedra de raio*.
Bicas: diversion channels to bring water to the mining works for the washing of the *cascalho*.
braça quadrada (square fathom): ancient unit of surface area of Brazil, equivalent to 4.84 m2
braço, punhal e fuzil (arm, dagger and rifle): contemporary expression illustrating the Brazilian "Wild West" in the 19th and 20th centuries.
Bragança: Portuguese royal family and then also imperial of Brazil. Late name of the "Great Diamond of Portugal.
branco: diminished ethnic classification for light-skinned ("white") people.
Square fathom: see *braça quadrada.*
brejo: marsh or wetlands.
cabocla (or *caboclo*, Indian stone). Groups together many varieties of rocks and minerals that make up *cascalho*, often yellow to red and including red hematite or rocks rich in this mineral (itabirite, jasper etc).
caboclo: Native Americans but also people from a single Native American parent.
caldeirões: cauldrons of river giants that can be enriched with diamondiferous gravels.
canaes or *canãoes:* narrow channels at the bottom of rivers that can be enriched with diamondiferous gravels.
canga: indurated and tenacious volumes of *cascalho*, often equated with *cascalho* by mineralogists.
capangueiro: Diamond trader, buying from miners.
carat (from the carob seed): unit of measurement of the weight of gems, unified in 1907 at 0.2 grams: 1 gram is equal to 5 carats.
carbonado: a very tenacious polymicrocrystalline rock, composed almost exclusively of diamonds, almost black and opaque, also known as a "black diamond" by simplification by gemologists and jewellers.
carbonate (or *carbonato*): name of the Chapada Diamantina for carbonado.
carbonite: carbonado in Old German.
carrapata: tick.
carumbé: large bowls for transport or washing like a pan.
cascalhão: large trench in gravel deposits.
cascalho: gravels rich in gold or gems such as diamonds.
cascalho de mocororo: low-relief gravel, often near streams.
cascalho de rapa: sparsely spliced layer of diamondiferous *cascalho*.
cavadeira: excavator (miner's tool).
chambado: a variety of black ferriferous titanium oxide.
clastic: (or detrital) refers to a rock composition rich in debris resulting from the alteration of rocks in a continental context. Depending on the size of the debris, we mainly identify clays (microscopic), sand, sandstone, conglomerate. They form the bulk of colluvium and alluvium (see these words).
colluvium: loose deposit of clastic rocks deposited by gravity on a slope, a slope.
Comendador: Commander.
Companhias de Mineração: consortia to exploit a concession.

*conto de réis (*account of reals): written as "R$ 1:000$000" and indicates one million units of currency, including the *real* (plural: *reals* or *reis*) that was current until 1910. Even today, a thousand ancient escudos are called *um conto de réis* (a million reals).
Coronel (colonel): military rank often linked to the eponymous war waged in the TWENTIETH century by various small regional colonels with clannish if not mafia-like tendencies (nepotism, corruption, etc.) that bloodied Brazilian political life at the time.
córrente: stream.
curriolo: *cascalho* cottages in the heart of streams or rivers.
diamond: a mineral composed almost exclusively of carbon, forming cubic crystals (octahedrons, etc.) and can be very diversely coloured.
carbonic diamond: synonym of carbonado in old writings.
Mohs scale: an empirical scale of mineral hardness established by the German mineralogist Mohs in the 19th century. It is established on 10 degrees ranging from 1 (talc) to 10 (diamond). Despite its inaccuracy, it is still widely used.
engrunada: underground mining, often in the mountains.
enxadão: hoe (miner's tool).
esmeril: means many things ranging from certain varieties of magnetite to *cascalho* felled and ready for washing (locally known as *ismiril*).
estrellado: large-block congomerate.
Étoile du Sud: name given by the Parisian diamond dealer Joseph (Frédéric) Halphen to an important 261.38-carat Brazilian diamond discovered in 1853 that he purchased, had faceted by the workshops of Martin E. Coster in Amsterdam in the form of an elongated oval, pale brown-pink, 128.48-carat brilliant diamond that he sold to Prince Malhār Rāo of Gaekwad, eleventh Maharâja of Baroda. It was then renamed *Estrela do Sud* in Brazil and then *Star of the South* by English speakers.
euhedral: mineral forming crystals well delimited by its natural facets.
exadas: miner's tool used to dig gravel.
faisca (spark): originally a gold nugget coveted by prospectors, more generally an opportunistic prospection for gold or diamonds (*faisqueira*)
faiscadore: spark seeker (see *faisca*), small individual prospectors not considered garimpeiros.
faisqueras: a kind of light prospecting for a day or two with small equipment (shovel, sieve) often carried out in old excavated material by amateurs or beginners.
favas (broad beans): name given to many types of rounded elongated gravel whose colour varies according to the mineral species: *amarellas* (gorxeicite, florencite) etc. See *feijões.*
fazenda: large landed property often linked to agriculture.
fazendeiro/fazendeira: owner (male/female) of a fazenda.
feijões (beans): name given to many types of very rounded gravel whose colour varies according to the mineral species: black (schorl, jasper) etc. We must avoid seeing too strict a relationship between these names and species in the scientific sense of the term.
ferragems (do cobre, prato, de prata, azul): name of garimpeiro corresponding to various substances of ferruginous appearance.
ferrajão (scrap metal): initially given to carbonado because of its black colour reminiscent of tarnished iron.
figados de cágado, de galhina (turtle livers, chicken livers): red chalcedony and jasper of a more angular shape).
formação: association of minerals accompanying another, in this case diamond (paragenesis in geology).
Frincha: large narrow cracks, some of which were very rich in diamonds (diaclases).
frincheiro: a kind of large trowel.
fulgurite: pieces of natural silica with a roughly tubular shape and resulting from the impact of lightning in siliceous sediments (sand).
garimpo: mining, exploitation (synonymous with *serviço*).
gem(stone): (noun) synonymous with precious stone but in a broader sense; (adjective) quality of transparency or of mining origin: one could almost write "rock salt can be a gem that is quite gem".
geodiversity: like biodiversity, all the different substances that make up the Earth's geological sphere: minerals including biominerals, rocks, fossils, meteorites, etc.
geomaterial: all natural materials forming geodiversity.
goniometer: a device used to measure the angles of solids, including crystals. Babinet's uses a light beam,

which is more accurate than the older variants which are purely mechanical (such as Carangeot's).

gorghalo/gorgulho: conglomerate located above the diamondiferous layers in the Chapada Diamantina.

gruna: see engrunada.

gruparia (or *gruppiara*): small-scale mining in the rocky debris below the slopes and having been enriched for the purpose of millions of years of erosion that have led to lighter minerals.

gruta: cave.

gupar(r)ia: see *gruparia*.

hydronováčekite: uranium-bearing mineral forming attractive yellow crystals, with a composition of $Mg(UO_2)_2(AsO4)_2 \cdot 12H_2O$ and crystallizing in the triclinic system. Dedicated to the Czech mineralogist Radim Nováček (1905-1942).

Inconfidência Mineira: Minas Gerais Conspiracy, an abortive revolt in 1789 by the Portuguese colonists of Minas Gerais (hence the adjective *Miniera*) against the colonial excesses of the Portuguese crown.

IPHAN (*Instituto do Patrimônio Histórico e Artístico Nacional):* Brazilian body in charge of the protection of historical and artistic heritage.

isokite: phosphate forming small brown crystals, of CaMg(PO4)F composition and crystallizing in the monoclinic system. Named after the town of Isoka (Zambia) where the Nkumbwa Hill deposit is located where it was first identified.

itabirite: banded rock composed of hematite (iron oxide) and silica, formerly called jaspers (ferruginous) currently forming *the BIF* (*Banded Iron Formation*) indicative of a major oxygenation of the Earth's atmosphere as early as 3 billion years ago. These rocks are the most important iron ore currently, with vast areas of an ore often more than 60% iron, particularly in Brazil (Minas Gerais) and Australia (Pilbara).

jarê: a "candomblé" from Bahia mixing African, Amerindian and Christian traditions.

jeje: or ewé, a community of African peoples originally from Ghana-Benin-Togo-Nigeria (also called Fons, Minas, Fantis, Axântis) who have culturally merged in part with the Nagôs (see this name).

karat: old carat from before 1907, often written "carat", whose value varies according to place and period. In Paris, it is worth 1,027 carats today. At the source of many confusions of weight of gemmologists who are not historians. See carat.

kimberlite: magmatic rock rich in peridot, potassium and water that carries diamonds formed in the Earth's mantle to the surface during a supersonic upwelling of these particular extremely explosive magmas. These chimneys form the primary deposits of diamonds: they are often mined in the open pit via concentric tiers sinking from the periphery to the centre of the mine. Other rocks carry diamonds, such as lamproites and komatiites, which geologists know how to differentiate.

lavagem: areas of gravel leaching.

Lavras Diamantinas: Diamond mines, historical name of the diamond deposits of the Chapada Diamantina.

Leschot (system): hydraulic core drilling machine equipped with drill bits set with carbonados that have considerably accelerated the time of drilling galleries, oil wells, railway tunnels or navigation canals. Despite the patent, the system was quickly copied by American entrepreneurs.

livusia: term used by north-eastern Brazilians to describe ghosts or a kind of haunting.

machadinha de índio (Indian hatchet): an old to recent stone tool such as a biface or an axe head.

twin/twinned (crystals): in crystallography, a twin is an association of two (or more) crystals according to precise laws dictated by laws of symmetry. Diamond crystals form various twins known as "spinel law", "Star of David" etc.

malacaixita (or *malacacheta*): muscovite-phlogopite mica but also talc and even talcschist.

mandiocas (literally "cassava"): former ultra-conservative political group and slave-rousers from the vicinity of Salvador (who grew cassava there, hence their name, also known as "Bahian"), responsible for a number of coups d'état and leaders of militias. Violently opposed to the *pinguelas* via personal quarrels between local military leaders.

marimbus: swamps (in the genus of the Pantanal).

marrãos: large iron hammers for breaking stones.

metazeunerite: uranium-bearing mineral forming attractive bright green crystals, with a composition $Cu(UO2)_2(AsO4)_2 \cdot 8(H2O)$ and crystallizing in the quadratic system. Dedicated to the German physicist Gustav Anton Zeuner (1828-1907).

meteorite: rocks of extra-terrestrial origin that have fallen to the Earth's surface.

*mineração de cascalho (*gravel mining): below the *high-altitude Mineração de Morro* .

mineração de morro (mountain exploitation): see serviço de Serra.
mocororô: mining waste ("waste") from *cascalho* and other rocks demobilized by miners. Sediment abundantly in the meanders of rivers and the bottom of river valleys below.
monchõe: mound of clay and/or gravel to be exploited in plots.
Nagô: name designating the Yoruba, a vast community of African peoples originally from West Africa (Nigeria, Benin, Burkina Faso, Togo, Ivory Coast, Ghana). In Brazil, these communities have merged with the *jeje* (see this name), particularly in the context of the various candomblés (voodoo and orixha).
octahedron: simple crystalline form, formed by two pyramids with four faces each (cf. the pyramids of Giza in Egypt) and joined by their base. This shape is geometrically related to the cube from which it is derived.
oitava: ancient unit of weight worth about 28.7 g.
osso de Cavallo (horse bone): component of *cascalho* corresponding to fibrolite, the old name for sillimanite.
ovo de pombo (pigeon's egg): milky rolled quartz or chalcedony.
oxisol: soil formed in an equatorial context, formerly known as laterite. Draining quickly (hence its great lack of mineral trace elements), it is enriched with aluminium, iron and silica. Washes out quickly in case of deforestation. May form stubborn indurated scabs.
pedra de Corisco: lightning stone (see *Pedra de Raio*).
pedra de Raio (lightning stone): unscientific and variable designation for various stones (crystals, fossils, etc.) with remarkable geometry but arousing fear.
pedra Sant 'Anna (stones of Sainte Anne): various rocks but also "limonitized" pyrites in goethite found in the *cascalho*.
pedrista: Bahian term for a gem trader, trusted intermediary between miners and workshops but also investors within a consortium for the purchase of very valuable gems.
image stone: stone, often limestone, showing textures most often evoking the semblance of landscapes.
pinga d'Agoa (drop of water): hyaline quartz or topaz (any colourless mineral forming pretty little multi-centimetre pebbles).
pingela: a former political group, rather conservative/liberal promoting the abolition of slavery (while retaining its "advantages"), strongly opposed to the *Mandiocas* (see this name).
pissara (or piçar(r)a): any bedrock rock, never diamondiferous (with some exceptions).
*poçãos (*or *poços):* deep wells in the bottom of rivers that can be enriched with diamondiferous gravels.
polymicrocrystalline: assembly of various micro-crystals giving the impression, to the naked eye, of a homogeneous compound (examples: agate and other chalcedony, obsidian, carbonado, jades).
primary: in geology, is said of a deposit made up of rocks that are emblematic of the geological context of its formation and that have not been disturbed or only slightly disturbed since then, either mineralogically or tectonically speaking. Opposes secondary.
ralos: drains used to refine gravel for washing.
rhombododecahedron: a polyhedron with twelve identical diamond-shaped faces. This crystalline form is common in garnets, including almandine. For the diamond, it is actually a hexahedron, the dominant shape of the diamonds of the Chapada Diamantina.
riacho (or rio): river.
secondary: is said when the rocks of a primary deposit have been greatly affected and redistributed (or even disappeared) by other geological mechanisms such as weathering, erosion, sedimentation, etc.
sellaite: mineral forming white to colourless masses, rarely crystals, of MgF_2 composition and crystallizing in the quadratic system. Dedicated to the Italian engineer Quintino Sella (1827-1884).
serviço: mining, exploitation (synonym of *garimpo*).
serviço do Campo: mining over a relatively large area, especially in the plateaus in the middle mountains.
siricoria (or *sirecora* or *sericória*): component of *the cascalho* corresponding to any translucent to transparent crystal such as colourless anatase, topaz, euclase, monazite, chrysoberyl...
sobrado: typical patrician's house in "colonial" style (although here it is rather the Brazilian imperial era) with two floors and illustrating the high social status of its owner.
tauá: a fairly loose diamondiferous layer of the Chapada Diamantina between sandstone and conglomerates.
toca: rock shelters transformed into *a rock and* austere dwelling of a miner, almost a hermitage, mainly

located in the mountains.
veio: the deepest area of the rivers where diamonds can be preferentially concentrated.
vidros: component of *cascalho*, especially xenotime, a fairly dense phosphate of yttrium (YPO_4) quite rare, most often yellow to brown in colour and forming small quadratic crystals.

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Any book is living matter, as Roy R. Funch wrote in 2004: I am convinced that there are still mistakes to be made, between logic, facts and writing, especially where the Chapada Diamantina is concerned.

Disclaimer: This book, an essay duly justified by numerous scientific references, was written by a human being, myself, who is the author declared above, who, beyond my original text, is the discoverer described here. I have cited all the authors of the quotations I have taken from them without introducing any plagiarism or explicitly naming the creators of the quotations and iconographies borrowed, all of which are free of copyright (Wikimedia Commons, archive.org etc.), although I have corrected some of their defects or errors in colour, exposure etc. (these modifications are indicated in the captions). All the other illustrations are mine (photographs and drawings), some of which are linked to the MNHN collections and therefore under copyrights. Those from Gallica/BnF are authorised for a research book such as this, even if they are intended for 'commercial' use, which is not the aim of this book.

Furthermore, I solemnly declare that I have no conflict of interest with anyone (person, institution, company), intellectual, moral or commercial, on any of the subjects covered in this book. I acknowledge that my discovery followed a request from two Australian colleagues, Robin Hansen and Léonie J. Rennie, who put me on the path to this diamond: I have credited them on several occasions. However, the information quoted and presented here is solely the fruit of my own research, independent of that carried out by Robin and Léonie, the details of which I did not know at the time this book was being finalised, but which corresponds to two articles in English accepted for publication in the Australian Gemologist and for which I shared my then-known information and various unpublished photographs.

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